

Boulder Reservoir 2013 Breeding and Migratory Bird Study for Boulder Parks and Recreation Department



Stephen R Jones, Environmental Consultant
3543 Smuggler Way, Boulder CO 80305
curlwsj@comcast.net

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Abstract

With the help of more than 20 Boulder Parks and Recreation staff and volunteers, I completed an April-July comprehensive breeding and migratory bird inventory at Boulder Reservoir and on Boulder Parks and Recreation lands surrounding the reservoir. During more than 55 hours of fieldwork, we observed a total of 114 bird species, of which 82 are potential nesters within the study area and 29 were confirmed nesting. Since 1995, various observers have reported at least 224 bird species at and within 1 km of Boulder Reservoir.

The wetlands on the west side of the reservoir and west of Coot Lake support unusually high concentration of Boulder County nesting birds of special concern, including American Bittern (isolated and restricted), Osprey (isolated and restricted), and Northern Harrier (rare and declining). These wetlands contain roughly half of all American bittern nesting territories documented in Boulder County since 1980. They support the only recently successful Northern Harrier nesting sites in Boulder County. They also support three Osprey nests, which have fledged 33 young since 2004.

Other Boulder County birds of special concern that have nested or may nest at the reservoir include Long-billed Curlew, Burrowing Owl, Loggerhead Shrike, Grasshopper Sparrow, and Bobolink. Colorado Natural Heritage Program tracked species observed at the reservoir during 2013 were American White Pelican, White-faced Ibis, Bald Eagle, Long-billed Curlew, Forster's Tern, and Bobolink.

The mosaic of cattail marshes, sedge/rush meadows, willow thickets, cottonwood groves, and mud flats surrounding the Dry Creek inlet at the northwestern corner of the reservoir nourishes several dozen species of migrating and nesting ducks, herons, and shorebirds. During May and June surveys, we observed Wood Ducks, Gadwalls, American Wigeons, Blue-winged Teal, Cinnamon Teal, Northern Shovelers, Northern Pintails, Green-winged Teal, Double-crested Cormorants, American White Pelicans, Great Egrets, Semipalmated Plovers, American Avocets, and a variety of other ducks and shorebirds foraging in this inlet. Cattail marshes in the Little Dry Creek drainage immediately west of the reservoir supported only small and isolated numbers of ducks, herons, and shorebirds. Excessive crowding of cattails in this area may inhibit nesting and foraging opportunities for these marsh-dependent species.

Areas of steeper shoreline along the west and north shore of the reservoir supported low numbers of migratory and nesting birds. In these areas, the "bathtub ring" effect--whereby large areas of bare lakeshore remain exposed in early spring--creates an inhospitable barrier between the reservoir surface and sheltering shoreline vegetation, precluding successful nesting by most ducks and shorebirds.

Though we observed a number of grassland-nesting bird species around the reservoir, nesting populations appear to be low compared to grassland-nesting bird populations in more natural prairies east of Boulder County. Most grasslands at Boulder Reservoir are in poor condition and dominated by non-native grasses and forbs. Restoration of these grasslands to a more natural condition would benefit a variety of prairie-nesting birds that once thrived on the plains of Boulder County, including Northern Harrier, Long-billed Curlew, Horned Lark, Lark Sparrow, Vesper Sparrow, and Grasshopper Sparrow.

Management strategies that enhance the diversity and extent of wetlands on the west side of the reservoir, protect these and other wetlands from incursions by recreational users and their pets, and restore native grasslands will benefit native bird populations at Boulder Reservoir. A major management challenge is protecting migratory nesting bird habitat from disturbance by the tens of thousands of recreationists who visit Boulder reservoir each year. Stronger enforcement of area closures, along with continued public education and outreach, will be necessary to sustain these vital habitats.

Introduction

With the assistance of Boulder Parks and Recreation staff and volunteers, I completed a breeding and migratory bird survey on Boulder Parks and Recreation lands surrounding Boulder Reservoir and Coot Lake during April-July 2013. The goals of the survey were:

1. Generate a comprehensive list of potential breeding and migratory birds within the study area. Identify habitats used for nesting or foraging by individual species.
2. Using distance sampling, develop estimates of absolute densities of individual species throughout the study area.
3. Document and map nesting and concentration areas for raptors, waterfowl, waders, shorebirds, and Federal, State, Colorado Natural Heritage Program, and Boulder County species of special concern.
4. Develop recommendations for preserving, enhancing, and protecting breeding and migratory bird habitat.

Study Area

Boulder Reservoir is a 285 ha multiuse recreational and water storage facility owned and managed by the City of Boulder and operated as a water supply by the Northern Colorado Water Conservancy District (Figure 1; Boulder Parks and Recreation Department website). The reservoir lies in central Boulder County within Township T1N, Section 3. The reservoir is surrounded by approximately 300 ha of Boulder Parks and Recreation Department-managed lands, including wetlands, grasslands, and scattered riparian woodlands. Coot Lake and its adjacent wetlands, approximately 50 m northeast of the reservoir outlet, are also managed by the City of Boulder. Public access for hiking, running, dog-walking, birdwatching, and other recreational activities is provided on most of these properties. Wetland areas immediately west and northwest of the reservoir and immediately west of Coot Lake are closed to the public during April-August, when American Bitterns, Ospreys, Northern Harriers, and other marsh-nesting birds breed in these areas.

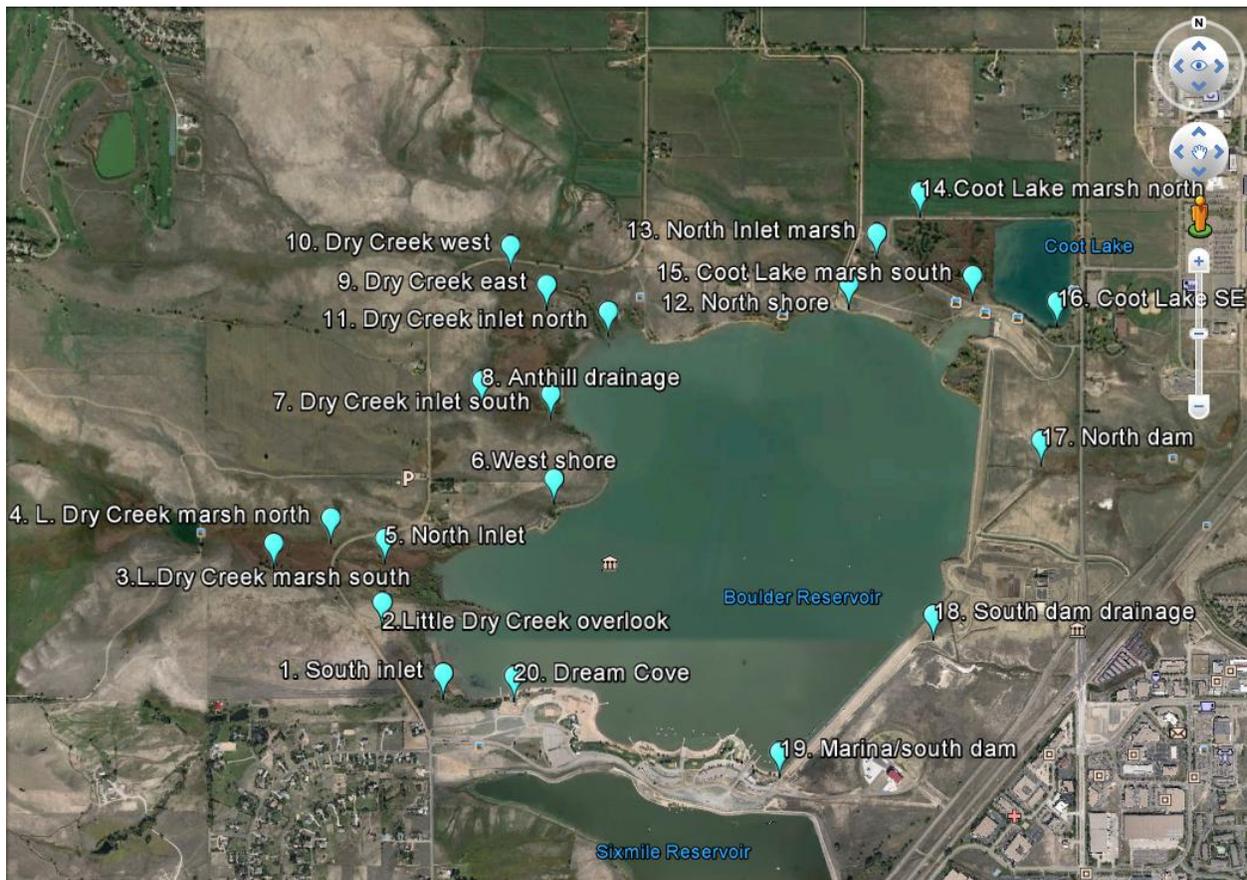
Vegetation within the public lands surrounding the reservoir includes cattail marshes, sedge/rush meadows; shortgrass prairie; mixed-grass prairie; riparian woodlands dominated by Plains Cottonwoods (*Populus deltoides*) and non-native willows; and shelter belts dominated by Rocky Mountain Juniper (*Sabina scopularum*) and introduced deciduous trees and shrubs (scientific names are from Weber 2012). Several prairie dog colonies exist in the Little Dry Creek and Dry Creek drainage west of the reservoir and below the reservoir dam. Grasslands throughout the City-managed lands surrounding the reservoir are dominated by non-native species, including Smooth Brome (*Bromopsis inermis*), Timothy (*Phleum pratense*), and Bindweed (*Convolvulus arvensis*).

The Little Dry Creek and Dry Creek drainages cut through the west side of the study area, forming extensive cattail marshes and sedge/rush meadows near their confluence with the reservoir. Another marsh area (about 10 ha in extent) lies just west of Coot Lake. Several unnamed ravines, some fed by

leakage and drainage from the reservoir dam and feeder canal, flow from and into the reservoir. These smaller drainages typically support small cattail marshes, along with scattered cottonwoods, Russian-Olives (*Elaeagnus Angustifolia*), and other deciduous trees.

Three private residences lie within the study area on the west and north sides of the reservoir. These properties support small groves of deciduous trees, along with small shelter belts containing Rocky Mountain Juniper (*Sabina scopularum*) and other non-native trees and shrubs.

Figure 1. Study area and point-count station locations.



Methods

During early April we established and mapped 20 point-count stations at least 250 m apart in diverse habitats around the reservoir and Coot Lake (Figure 1). We visited each point-count station once between 0430-0830 MST during 23-25 April, 13-15 May, 12-14 June, 27-29 June, and 11-13 July, counting all birds seen or heard perching or foraging within 200 m (12.56 ha plots) during 10 minutes. Birds flying through or over the plots were noted but not included in the population density analysis. We used a laser rangefinder to estimate the distance to each observed bird and used distance sampling software (Thomas et. al. 2010) to estimate the absolute density of the most abundant birds.

We used Colorado Breeding Bird Atlas II (2012) protocols to code breeding behaviors of all birds seen or heard. Birds seen or heard within suitable nesting habitat during their documented breeding season (Kingery 1998) were considered "potential nesting species." Birds exhibiting specific breeding behaviors (such as courtship, territorial defense, or territorial singing over a period of a week or more) within suitable nesting habitat were considered "probable nesting species," and birds observed in the act of nest building, incubation, brooding young, or feeding young--or with recently fledged young--were considered "confirmed nesting species."

We supplemented data from these surveys with observations by Boulder Parks and Recreation staff and field reports from 20 volunteers working on annual monitoring of birds of special concern at the reservoir (Jones 2006-13). We used records from the Boulder County Wildlife Inventory (1979-2013), eBird (1995-2013), previous monitoring studies (Jones 2006-13) and this study to compile a list of 224 bird species documented within the study area (Appendix III). We also used records from the Boulder County Monthly Wildlife Inventory to document presence of potential nesting species within the study area during five-year intervals from 1980-2013.

Results and Discussion

Between 10 April-31 July 2013 we observed 114 bird species within the study area, including 82 potential nesting species (birds seen or heard within suitable nesting habitat during their documented breeding season; Kingery 1998). This number of potential nesting species is comparable to numbers detected within protected lands surrounding other large reservoirs in eastern Colorado during recent studies using the same methodology.

Table 1. Potential nesting species documented in four reservoir parks in eastern Colorado.

Park	Observer Hours	Potential Nesting	CNHP Tracked Species ¹	Non-Native ²
Boulder Reservoir	55	82	6	5
John Martin Reservoir State Park ³	27	91	6	8
Lake Pueblo State Park ⁴	44	95	7	6
North Sterling Reservoir State Park ⁵	24	69	5	5

¹ Colorado Natural Heritage Program. 2012. Tracked bird species.

² Not documented nesting in Colorado prior to 1900 (Bailey 1902, Henderson 1908, Kingery 1998).

³ Jones 2013. ⁴ Jones 2011. ⁵ Jones 2008.

Potential nesting species observed during 2013 included 9 geese and ducks; 3 herons and ibis; 7 birds of prey; 2 rails; 5 shorebirds, 4 doves and owls, 2 woodpeckers, 4 flycatchers, 3 corvids, 4 swallows, 3 wrens and gnatcatchers, 3 thrushes, 2 warblers, 5 sparrows, 8 icterids, and 3 finches (Table 2).

Table 2. April-July 2013 observations.

Colorado Natural Heritage Program global ranking codes:

G3, vulnerable to extirpation or extinction; G4, widespread, abundant, and apparently secure;
 G5, demonstrably widespread, abundant, and secure; T, rank applies to subspecies or variety.

Colorado Natural Heritage Program state ranking codes:

S1, state critically imperiled; S2, state imperiled; S3, state rare or uncommon; S4, state
 apparently secure; B, breeding populations; N, non-breeding populations.

Boulder County Nature Association birds of special concern codes:

- 1: Rare and declining. Three or fewer annually documented nesting sites within the county.
- 3: Rare. Three or fewer annually documented nesting sites within the county.
- 4: Isolated and restricted (limited breeding habitat).
- 6: Extirpated as a locally breeding species.

Habitat abbreviations:¹

AEM: Emergent wetland	ASL: Shoreline	CPL: Croplands
CWD: Cultivated woodlands	LRD: Riparian woodland	MSB: Bridges
MSP: Poles	OWL: Open water	RRL: Rural residential
SLE: Shrublands	TMG: Mixed-grass prairie	TSG: Shortgrass prairie
TSU: Barren ground	UPK: City parks	

Species	Habitats	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
Canada Goose	AEM, ASL, OWL	Fledged young		
Wood Duck	AEM, OWL	Seen 28 June		
Gadwall	ASL, OWL	Pair		
American Wigeon	ASL, OWL	Pair		
Mallard	AEM, ASL, OWL	Fledged young		
Blue-winged Teal	ASL, OWL	Pair		
Cinnamon Teal	ASL, OWL	Seen 11 June		
Northern Shoveler	ASL, OWL	Seen 13 May, 11 June		
Northern Pintail	ASL, OWL	Observed non-breeder		
Green-winged Teal	ASL, OWL	Pair		
Redhead	ASL, OWL	Observed non-breeder		
Ring-necked Duck	OWL	Observed non-breeder		
Greater Scaup	OWL	Observed non-breeder		
Lesser Scaup	OWL	Observed non-breeder		
Common Merganser	OWL	Observed non-breeder		
Red-breasted Merganser	OWL	Observed non-breeder		
Northern Bobwhite	UPK	Seen 28 June		1
Pied-billed Grebe	AEM, OWL	Seen 5 May		
Eared Grebe	OWL	Observed non-breeder		1
Western Grebe	OWL	Observed non-breeder		
Clark's Grebe	OWL	Observed non-breeder		
Double-crested Cormorant	ASL, OWL	Observed non-breeder		

Species	Habitats	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
American White Pelican	ASL, OWL	Observed non-breeder	G3;S1B	
American Bittern	AEM	Territory		4
Great Blue Heron	ASL, LRD, OWL	Occupied nest		
Great Egret	ASL, OWL	Observed non-breeder		3, 4
Black-crowned Night Heron	ASL	Seen 5 May		
White-faced Ibis	ASL, AEM	Seen 13 May	G5;S2B	
Turkey Vulture	TMG	Observed non-breeder		
Osprey	MSP, ASL	Nest with young		
Bald Eagle	MSP, ASL	Observed non-breeder	G5;S1B,S3N	4
Northern Harrier	AEM	Pair		1, 4
Cooper's Hawk	LRD	Seen 22 April		
Swainson's Hawk	LRD	Pair		
Red-tailed Hawk	LRD	Nest with young		
Virginia Rail	AEM	Territory		
Sora	AEM	Territory		
American Coot	AEM	Territory		
Semipalmated Plover	ASL	Observed non-breeder		
Killdeer	ASL, AEM, TSU	Fledged young		
American Avocet	ASL, AEM	Pair		
Spotted Sandpiper	ASL	Feeding fledglings		
Lesser Yellowlegs	ASL	Observed non-breeder		
Long-billed Curlew	ASL, AEM	Seen 10 May	G5;S2B	6
Baird's Sandpiper	ASL	Observed non-breeder		
Wilson's Snipe	AEM	Fledged young		
Ring-billed Gull	ASL, OWL	Observed non-breeder		
Forster's Tern	OWL	Observed non-breeder	G5;S2B,S4N	
Rock Pigeon	MSP	Seen 11 June		
Eurasian Collared-Dove	LRD, RRL	Nest building		
Mourning Dove	LRD, RRL	Fledged young		
Great Horned Owl	RRL	Occupied nest		
Broad-tailed Hummingbird	AEM, LRD	Observed non-breeder		
Belted Kingfisher	ASL, AEM	Seen 11, 28 June		
Downy Woodpecker	LRD	Fledged young		
Northern Flicker	LRD	Fledged young		
American Kestrel	LRD	Territory		
Western Wood-Pewee	LRD	Singing male		
Say's Phoebe	TMG	Territory		
Western Kingbird	LRD, RRL	Nest with young		
Eastern Kingbird	LRD	Agitated behavior		
Loggerhead Shrike	TMG	Seen 25 April		1, 4
Warbling Vireo	LRD	Territory		
Blue Jay	UPK	Territory		
Black-billed Magpie	LRD, RRL	Fledged young		
American Crow	LRD, RRL	Fledged young		

Species	Habitats	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
Common Raven	LRD	Observed non-breeder		
Horned Lark	TSG	Seen 25 April		
Tree Swallow	AEM	Seen 11, 28 June		
Violet-green Swallow	AEM	Observed non-breeder		
Northern Rough-winged Swallow	AEM	Seen 25 April		
Cliff Swallow	AEM, ASL, TMG	Nest with young		
Barn Swallow	UPK, AEM	Occupied nest		
Black-capped Chickadee	LRD	Fledged young		
Mountain Chickadee	CWD	Observed non-breeder		
White-breasted Nuthatch	RRL	Seen 10 May		
House Wren	SLE	Territory		
Marsh Wren	AEM	Heard 2 June		
Blue-gray Gnatcatcher	CWD	Seen 13 May		
Mountain Bluebird	TMG	Seen 22 April		
American Robin	LRD, UPK	Carrying food		
Gray Catbird	SLE	Singing male		
European Starling	RRL, UPK, LRD	Carrying food		
Cedar Waxwing	LRD	Seen 3 June		
Orange-crowned Warbler	AEM, LRD	Observed non-breeder		
Common Yellowthroat	AEM	Territory		
Blackburnian Warbler	LRD	Observed non-breeder		
Yellow Warbler	LRD	Territory		
Yellow-rumped Warbler	LRD	Observed non-breeder		
Green-tailed Towhee	SLE	Pair		
Spotted Towhee	SLE	Seen 25 April		
Chipping Sparrow	LRD, TMG	Observed non-breeder		
Vesper Sparrow	TMG	Territory		
Lark Sparrow	TMG	Courtship		
Savannah Sparrow	CPL, AEM	Singing male		
Grasshopper Sparrow	TMG	Territory		4
Song Sparrow	AEM	Territory		
White-crowned Sparrow	AEM, LRD	Observed non-breeder		
Dark-eyed Junco	CWD	Observed non-breeder		
Blue Grosbeak	LRD	Fledged young		
Dickcissel	CPL, AEM	Territory		
Bobolink	CPL, AEM	Singing male	G5,S3B	4
Red-winged Blackbird	AEM, LRD	Feeding fledglings		
Western Meadowlark	TMG	Carrying food		
Yellow-headed Blackbird	AEM, ASL	Pair		
Brewer's Blackbird	LRD, UPK	Carrying food		
Common Grackle	LRD, UPK, RRL	Feeding fledglings		
Brown-headed Cowbird	LRD, UPK, RRL	Courtship		
Orchard Oriole	LRD	Singing male		
Bullock's Oriole	LRD	Nest with young		

Species	Habitats	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
House Finch	UPK, RRL	Fledged young		
Pine Siskin	CWD	Observed non-breeder		
Lesser Goldfinch	LRD	Seen 11 June		
American Goldfinch	LRD, UPK	Feeding fledglings		
House Sparrow	UPK	Seen 11 June		

¹ Habitat codes are from Kingery, H.E. 1998. Colorado breeding bird atlas.

² Species seen or heard within suitable nesting habitat during their documented breeding season are considered "possible breeders." Species exhibiting specific territorial behaviors are considered "probable" breeders. Species exhibiting nesting behaviors such as nest building, nest with eggs, or recently fledged young are considered "confirmed" breeders. "Observed non-breeders" include birds for which there is no suitable nesting habitat within the study area and conspicuous birds, such as Bald Eagle, for which there is no documentation of nesting within the study area (Kingery 1998).

³ Colorado Natural Heritage Program. 2012. Tracked bird species.

⁴ Hallock, D., and S.R. Jones. 2010. Boulder County avian species of special concern. Boulder County Nature Association, www.bcna.org. Also included in the Boulder County Comprehensive Plan.

Four additional potential nesting species (Burrowing Owl, Common Nighthawk, Red-headed Woodpecker, and Lark Bunting) were observed during surveys conducted by Boulder County Parks and Recreation volunteers monitoring birds of special concern from 2009-12 (Table 3). Of the 2009-13 total of 87 potential nesting species, 29 were confirmed nesting within the study area in 2013, and an additional 28 are probable breeders based on exhibited nesting behaviors (Tables 2 and 3).

Historic Changes in Nesting Bird Populations

Table 4 summarizes 1980-2013 observations of potential nesting species from Boulder County Wildlife Inventory area 22, which encompasses most of the study area, including all of Boulder Reservoir and lands east of North 51st Street, south of Monarch Road, west of North 63rd Street, and north of the Boulder-Longmont Diagonal Highway. Since there are no controls for observer effort in this inventory these observations are more suggestive of presence, rather than absence, of individual species. In other words, the absence of reports of a given species during a given five-year interval should not be interpreted as evidence that the species was not present. Moreover, since Boulder Parks and Recreation initiated their species of special concern monitoring program in wetlands surrounding the reservoir in 2004, numbers of reported observations to the wildlife inventory have no doubt increased.

Nevertheless, Boulder County Wildlife Inventory records to shed light on some changes in nesting bird populations at Boulder Reservoir. A total of 10 species which were not reported between 1980-99 reported during 2000-13: Wood Duck, Northern Bobwhite, Eurasian Collared-Dove, Red-headed Woodpecker, Blue Jay, Blue-gray Gnatcatcher, Gray Catbird, Cedar Waxwing, Dickcissel, and Orchard Oriole.

Table 3. 2009-13 potential breeding species observations.¹

Colorado Natural Heritage Program global ranking codes:

G3, vulnerable to extirpation or extinction; G4, widespread, abundant, and apparently secure;
G5, demonstrably widespread, abundant, and secure; T, rank applies to subspecies or variety.

State Ranking Codes:

S1, state critically imperiled; S2, state imperiled; S3, state rare or uncommon; S4, state apparently secure; B, breeding populations; N, non-breeding populations.

Boulder County Nature Association birds of special concern codes:

1: Rare and declining. Three or fewer annually documented nesting sites within the county.

3: Rare 4: Isolated and restricted (limited breeding habitat).

6: Extirpated as a locally breeding species.

Species	Years	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
Canada Goose	2009-13	Fledged young		
Wood Duck	2009, 13	Seen		
Gadwall	2012-13	Pair		
American Wigeon	2013	Pair		
Mallard	2009-13	Fledged young		
Blue-winged Teal	2009, 12, 13	Pair		
Cinnamon Teal	2012-13	Seen 11 June		
Northern Shoveler	2009, 13	Seen 13 may, 11 June		
Green-winged Teal	2013	Pair		
Northern Bobwhite	2013	Seen 28 June		1
Pied-billed Grebe	2009, 11, 13	Seen 5 May		
American Bittern	2009-13	Fledged young		4
Great Blue Heron	2009-13	Nest with young		
Black-crowned Night Heron	2009, 13	Seen 5 May		
White-faced Ibis	2012-13	Seen 13 May	G5;S2B	
Osprey	2009-13	Nest with young		
Northern Harrier	2009-11, 13	Nest with young		1, 4
Cooper's Hawk	2013	Seen 22 April		
Swainson's Hawk	2009-11, 13	Pair		
Red-tailed Hawk	2009-13	Nest with young		
Virginia Rail	2009, 12-13	Territory		
Sora	2009, 12-13	Territory		
American Coot	2009-11, 13	Territory		
Killdeer	2009-13	Fledged young		
American Avocet	2013	Pair		
Long-billed Curlew	2013	Seen 10 May	G5;S2B	6
Spotted Sandpiper	2009-13	Feeding fledglings		
Wilson's Snipe	2009-13	Fledged young		
Rock Pigeon	2009-13	Seen 11 June		
Eurasian Collared-Dove	2011-13	Nest building		

Species	Years	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
Eurasian Collared-Dove	2011-13	Nest building		
Mourning Dove	2009-13	Fledged young		
Great Horned Owl	2009-13	Nest with young		
Burrowing Owl	2011	Pair		
Common Nighthawk	2009, 11-12	Courtship		
Belted Kingfisher	2009, 11-13	Seen 11, 28 June		
Red-headed Woodpecker	2011	Seen 26 May		
Downy Woodpecker	2009, 11, 13	Fledged young		
Northern Flicker	2009, 11-13	Fledged young		
American Kestrel	2009-13	Territory		
Western Wood-Pewee	2009-13	Singing male		
Say's Phoebe	2011, 13	Territory		
Western Kingbird	2009-13	Nest with young		
Eastern Kingbird	2010-13	Agitated behavior		
Loggerhead Shrike	2013	Seen 25 April		1, 4
Warbling Vireo	2009, 12-13	Territory		
Blue Jay	2009, 11, 13	Territory		
Black-billed Magpie	2009-13	Fledged young		
American Crow	2009-13	Fledged young		
Horned Lark	2009-11, 13	Seen 25 April		
Tree Swallow	2010-13	Seen 11, 28 June		
N. Rough-winged Swallow	2009, 13	Seen 25 April		
Cliff Swallow	2011-13	Nest with young		
Barn Swallow	2009-13	Occupied nest		
Black-capped Chickadee	2009, 13	Fledged young		
White-breasted Nuthatch	2013	Seen 10 May		
House Wren	2009-10, 13	Territory		
Marsh Wren	2013	Heard 2 June		
Blue-gray Gnatcatcher	2013	Seen 13 May		
Mountain Bluebird	2013	Seen 22 April		
American Robin	2009-13	Carrying food		
Gray Catbird	2013	Singing male		
European Starling	2009-13	Carrying food		
Cedar Waxwing	2013	Seen 3 June		
Common Yellowthroat	2009-13	Territory		
Yellow Warbler	2009-13	Fledged young		
Green-tailed Towhee	2013	Pair		
Spotted Towhee	2013	Seen 25 April		
Vesper Sparrow	2009-10, 13	Territory		
Lark Sparrow	2012-13	Courtship		
Lark Bunting	2010-11	Seen 26 May, 16 June		1
Savannah Sparrow	2012-13	Singing male		
Grasshopper Sparrow	2009, 12-13	Territory		4
Song Sparrow	2009, 12-13	Territory		

Species	Years	Breeding Behavior ²	CNHP Tracked ³	BCNA Concern ⁴
Blue Grosbeak	2009, 11, 13	Fledged young		
Dickcissel	2012-13	Territory		
Bobolink	2011, 13	Singing male	G5,S3B	4
Red-winged Blackbird	2009-13	Nest with young		
Western Meadowlark	2009-13	Carrying food		
Yellow-headed Blackbird	2009-11, 13	Fledged young		
Brewer's Blackbird	2012-13	Carrying food		
Common Grackle	2009-13	Feeding fledglings		
Brown-headed Cowbird	2009-13	Courtship		
Orchard Oriole	2013	Singing male		
Bullock's Oriole	2009, 11-13	Nest with young		
House Finch	2009, 12-13	Fledged young		
Lesser Goldfinch	2013	Seen 11 June		
American Goldfinch	2009-13	Feeding fledglings		
House Sparrow	2009-11, 13	Seen 11 June		

¹ 2009-12 observations are from Jones, S.R. 2006-12. Boulder Reservoir species of special concern monitoring reports. Boulder Parks and Recreation Department, 3198 Broadway, Boulder CO 80304.

² Species seen or heard within suitable nesting habitat during their documented breeding season are considered "possible breeders." Species exhibiting territorial behaviors are considered "probable" breeders. Species exhibiting nesting behaviors such as nest building, nest with eggs, or recently fledged young are considered "confirmed" breeders. "Observed non-breeders" include birds for which there is no suitable nesting habitat within the study area and conspicuous birds, such as Bald Eagle, for which there is no documentation of nesting within the study area (Kingery 1998).

³ Colorado Natural Heritage Program. 2012. Tracked bird species.

⁴ Hallock, D., and S.R. Jones. 2010. Boulder County avian species of special concern. Boulder County Nature Association, www.bcna.org. Also included in the Boulder County Comprehensive Plan.

Table 4. Historical observations of potential nesting species at or within 1 km of Boulder Reservoir from Boulder County Audubon Society 1979-2013 monthly wildlife inventories. ¹

X: Indicates that the species was reported during at least one month, April-August, during the indicated five-year period, within wildlife inventory area 22, which encompasses Boulder Reservoir and lands north from the reservoir to Monarch Road and south from the reservoir to Colorado State Highway 119.

Species	1980-4	1985-9	1990-4	1995-9	2000-4	2005-9	2010-3
Canada Goose	X	X	X	X	X	X	X
Wood Duck					X	X	X
Gadwall	X	X	X	X	X	X	X
American Wigeon	X	X	X	X	X	X	X
Mallard	X	X	X	X	X	X	X

Species	1980-4	1985-9	1990-4	1995-9	2000-4	2005-9	2010-3
Mallard	X	X	X	X	X	X	X
Blue-winged Teal	X	X	X	X	X	X	X
Cinnamon Teal	X	X	X	X	X	X	X
Northern Shoveler	X	X	X	X	X	X	X
Green-winged Teal	X	X	X	X	X	X	X
Northern Bobwhite							X
Pied-billed Grebe	X	X	X	X	X	X	X
American Bittern				X	X	X	X
Great Blue Heron	X	X	X	X	X	X	X
Black-crowned Night Heron	X	X	X	X	X	X	X
White-faced Ibis		X	X	X	X	X	X
Osprey	X		X	X	X	X	X
Northern Harrier	X	X	X	X	X	X	X
Cooper's Hawk			X				X
Swainson's Hawk	X	X	X	X	X	X	X
Red-tailed Hawk	X	X	X	X	X	X	X
Virginia Rail	X	X		X	X	X	X
Sora	X	X		X	X	X	X
American Coot	X	X	X	X	X	X	X
Killdeer	X	X	X	X	X	X	X
American Avocet	X			X		X	X
Long-billed Curlew			X	X	X	X	X
Spotted Sandpiper	X	X	X	X	X	X	X
Wilson's Snipe	X	X	X	X	X	X	X
Rock Pigeon	X	X	X	X	X	X	X
Eurasian Collared-Dove						X	X
Mourning Dove	X	X	X	X	X	X	X
Great Horned Owl	X	X	X	X	X	X	X
Burrowing Owl	X	X	X	X	X	X	X
Common Nighthawk	X	X	X	X	X	X	X
Belted Kingfisher	X	X	X	X	X	X	X
Lewis's Woodpecker	X						
Red-headed Woodpecker							X
Downy Woodpecker	X	X	X	X	X	X	X
Northern Flicker	X	X	X	X	X	X	X
American Kestrel	X	X	X	X	X	X	X
Western Wood-Pewee	X	X	X	X	X	X	X
Say's Phoebe	X	X	X		X	X	X
Western Kingbird	X	X	X	X	X	X	X
Eastern Kingbird	X	X	X	X	X	X	X
Loggerhead Shrike	X	X			X	X	X
Warbling Vireo	X	X	X	X	X	X	X
Blue Jay	X	X	X	X		X	X
Black-billed Magpie	X	X	X	X	X	X	X
American Crow	X	X	X	X	X	X	X

Species	1980-4	1985-9	1990-4	1995-9	2000-4	2005-9	2010-3
Horned Lark	X	X	X	X	X	X	X
Tree Swallow	X	X	X	X	X	X	X
N. Rough-Winged Swallow	X	X	X	X	X	X	X
Cliff Swallow	X	X	X	X	X	X	X
Barn swallow	X	X	X	X	X	X	X
Black-capped Chickadee	X	X	X	X	X	X	X
White-breasted Nuthatch		X			X		X
Rock Wren	X	X					
House Wren	X	X	X	X	X	X	X
Marsh Wren			X		X	X	X
Blue-gray Gnatcatcher						X	X
Mountain Bluebird	X	X	X	X	X	X	X
American Robin	X	X	X	X	X	X	X
Gray Catbird						X	X
European Starling	X	X	X	X	X	X	X
Cedar Waxwing							X
Common Yellowthroat	X	X	X	X	X	X	X
Yellow Warbler	X	X	X	X	X	X	X
Green-tailed Towhee	X	X					X
Spotted Towhee	X	X	X	X	X	X	X
Vesper Sparrow	X	X		X	X	X	X
Lark Sparrow	X	X	X	X	X	X	X
Lark Bunting	X	X		X	X	X	X
Savannah Sparrow	X	X		X	X	X	X
Grasshopper Sparrow	X	X	X			X	X
Song Sparrow	X	X	X	X	X	X	X
Black-headed Grosbeak	X	X	X	X	X	X	X
Blue Grosbeak	X	X		X		X	X
Dickcissel							X
Bobolink	X					X	X
Red-winged Blackbird	X	X	X	X	X	X	X
Western Meadowlark	X	X	X	X	X	X	X
Yellow-headed Blackbird	X	X	X	X	X	X	X
Brewer's Blackbird	X	X	X	X	X	X	X
Common Grackle	X	X	X	X	X	X	X
Brown-headed Cowbird	X	X	X	X	X	X	X
Bullock's Oriole	X	X	X	X	X	X	X
Orchard Oriole							X
House Finch	X	X	X	X	X	X	X
Lesser Goldfinch		X		X			X
American Goldfinch	X	X	X	X	X	X	X
House Sparrow	X	X	X	X	X	X	X

¹ The Boulder County monthly wildlife inventory is an informal compilation of bird sightings submitted by local volunteers to the Boulder County Audubon Society. Since there are no controls on the amount of observer effort, these observations are more suggestive of the presence of, rather than the absence of, individual species. Observers report their sightings monthly from 50 mapped areas within Boulder County.

Wood Ducks, Blue Jays, and Orchard Orioles are native to eastern North America, and their numbers have increased throughout eastern Boulder County since 1980 as native cottonwoods and non-native willows have proliferated along prairie streams (Boulder County Audubon Society 1979-2013, National Audubon Society 2013). Northern Bobwhites and Red-headed Woodpeckers are rare and declining nesting species in Boulder County (Hallock and Jones 2010), and each was reported only once within the study area during 2000-13.

Eurasian Collared-Doves are native to the Indian subcontinent and were first reported in North America during the 1980s, when caged birds imported to the Bahamas somehow made their way to Florida (Fuller 2004). They have since radiated out throughout much of North America, including Alaska (Fuller 2004). Blue-grey Gnatcatchers and Gray Catbirds are native shrub-nesters whose numbers may have increased in Boulder County in recent decades as cattle were removed from plains and foothills shrubland areas, enabling shrub-nesting habitat to expand (Boulder County Audubon Society 1979-2013; Chase and Cruz 2013).

Dickcissels nest in tallgrass prairies and disturbed agricultural fields throughout the central and eastern Great Plains (Kingery 1998b). Singing males occasionally irrupt into Boulder County during late spring and early summer of years when drought conditions impact large areas of the Great Plains (Kingery 1998b, Boulder County Audubon Society 1979-2013). Dickcissels have never been documented nesting successfully in Boulder County (Hallock and Jones 2010).

Several potential nesting species, including Blue-winged Teal, Cinnamon Teal, Northern Harrier, and Burrowing Owl, were reported more frequently within the study area during 1980-99 than during 2000-13 (Boulder County Audubon Society 1979-2013). See the Species of Special Concern section on page 29 for a discussion of some of these species. Lewis's Woodpecker was reported once within the study area, in October 1984. Mature cottonwoods along the shoreline of Coot Lake could constitute potential nesting habitat (Kuenning 1998). Rock Wrens were reported within the study area during the 1980s and 1990s but haven't been reported since 2000. They typically choose broken cliffs for nesting, but they can also nest on talus slopes and dam abutments (Jones 1998), so periodic nesting at the reservoir is conceivable.

Nesting Bird Population Densities

Table 5 shows estimated breeding season (June-July) population densities of the 13 most abundant species observed during 2013, derived from distance sampling and analysis in the program Distance

(Thomas et. al. 2010), employing a half-normal cosine model. Distance is a Windows-based computer package developed in Scotland to analyze distance-sampling surveys of wildlife populations. The program examines the numbers of a given species observed at various distances and then assigns a detectability index to each species. The index is applied to estimate the absolute density of a given species within the survey area (Thomas et. al. 2010).

Table 5. Estimated density/ha of most abundant species.

Species	Number/point/survey	Estimated density/ha	Density Range at 0.95 confidence interval ¹	Coefficient of Variation ²
Red-winged Blackbird	5.12	8.048	6.678 - 9.698	.095
Cliff Swallow	4.30	3.405	2.226 - 5.207	.218
American Goldfinch	0.79	1.811	1.268 - 2.586	.179
Canada Goose	2.61	1.771	.781 - 4.016	.428
Common Grackle	0.79	1.725	.880 - 3.382	.344
American Robin	0.49	.792	.518 - 1.209	.210
Brown-headed Cowbird	0.59	.690	.515 - .923	.144
Mallard	1.19	.489	.182 - 1.312	.531
Common Yellowthroat	0.95	.435	.322 - .588	.151
Yellow Warbler	0.77	.402	.311 - .519	.129
Mourning Dove	0.90	.371	.237 - .579	.224
Killdeer	0.52	.348	.159 - .763	.402
Western Meadowlark	1.41	.180	.131 - .246	.160

According to the analysis in Distance, Red-winged Blackbird was by far the most abundant breeding species within the study area, followed by Cliff Swallow, American Goldfinch, Canada Goose, and Common Grackle. However, the software is much better at estimating populations of smaller songbirds which tend to be evenly distributed within a given habitat type than of ducks and other larger birds that may aggregate into summer flocks. Since most of the Canada Geese and Mallards counted from point-count stations in June and July had already aggregated into flocks and most sightings were at a distance of > 100 m from the observer, estimates of absolute density of these species within the study are unreliable (see Density Range and Coefficient of Variation columns in Table 6). In addition, Distance can generally make reliable density estimates only when provided with at least 60 observations of a given species. Of the songbirds observed from point-count stations, only Cliff Swallow, Red-winged Blackbird, and Western Meadowlark met this criterion (see Number/Point/Survey column).

Nevertheless, the analysis does suggest that Red-winged Blackbird is by far the most abundant nesting songbird species within the study area, followed in estimated density by Cliff Swallow, American Goldfinch, Common Grackle, American Robin, Brown-headed Cowbird, Common Yellowthroat, Yellow Warbler, Mourning Dove, and Western Meadowlark. Of these 10 species, two nest predominantly in marshes (Common Yellowthroat and Red-winged Blackbird), one nests predominantly in riparian woodlands (Yellow Warbler), one nests predominantly in a mixed grasslands (Western Meadowlark),

and the remaining six are habitat generalists that nest in a wide variety of ecosystems, including urban areas (Kingery 1998).

These estimated densities reflect the proximity of Boulder Reservoir to several urban areas, the presence within the study area of buildings, bridges, and other structures where urban-adapted generalists often nest, and the coverage of much of the study area by cattail marshes and mixed grasslands. While these data may be of limited value when analyzing habitat quality and management, they do provide a baseline for comparing Boulder Reservoir bird populations over time and with bird populations within other semi-urban parks throughout Colorado. For example, a future decrease in the density of Common Grackles and Brown-headed Cowbirds might indicate a reduction in the amount of native habitat fragmentation within the study area.

Nesting Bird Concentration Areas

Highest numbers of potentially breeding birds were observed in wetlands and cottonwood groves in the Dry Creek drainage and shoreline area at the northwest corner of the reservoir, the Little Dry Creek south inlet at the southwest corner of the reservoir, and the wetlands to the west of Coot Lake (Tables 6 and 7; Appendix IV). During May and June the Dry Creek inlet supported at least 21 species of foraging waterfowl, waders, and shorebirds, including Blue-winged Teal, Cinnamon Teal, Northern Shoveler, Green-winged Teal, Great Egret, White-faced Ibis, American Avocet, and Semipalmated Plover (Table 11). However, of the waterfowl, herons, and shorebirds observed within the inlet, only Canada Goose, Mallard, Killdeer, Spotted Sandpiper, and Wilson's Snipe appear to have nested successfully.

Shallows and wetlands on the west side of Coot Lake supported concentrations of migratory waterfowl and grebes, including Canada Goose, Mallard, Redhead, Lesser Scaup, Greater Scaup, Ring-necked Duck, Common Merganser, Red-breasted Merganser, Eared Grebe, and Western Grebe. However, of these species only Canada Goose and Mallard demonstrated behaviors (such as territorial defense or fledged young) consistent with actually nesting in these wetlands.

Crowded cattail marshes in the Little Dry Creek drainage appear to support lower numbers of nesting species and individuals than do the more vegetatively complex marshes in the Dry Creek drainage and west of Coot Lake. The Dream Cove area, just northeast of the Boulder Reservoir entrance gate, supported relatively high numbers of individuals during both migratory and breeding bird surveys; however, nearly two-thirds of these birds were urban-adaptive generalists such as Canada Goose, Mallard, American Robin, and European Starling.

Areas of steeper shoreline along the west and north shores of the reservoir supported relatively low numbers of migratory and nesting birds. In these areas, the "bathtub ring effect"--whereby large areas of bare shore are exposed in early spring and create an inhospitable barrier between the reservoir surface and any sheltering shoreline vegetation--probably precludes successful nesting by most ducks and shorebirds.

Table 6. Breeding Season (June-July) Point-Count Summary. From three, 10-minute counts (11-12 June, 28-29 June, 12-13 July).

Point No.	Location	Mean Species	Mean Individuals	Total Species	CNHP Tracked ¹	BCNA Concern ²	Non-Native ³
1	L. Dry Creek south inlet	10.7	29.7	16	0	0	1
2	L. Dry Creek overlook	11.0	40.0	19	1	0	2
3	L. Dry Creek marsh south	8.7	18.7	14	0	0	0
4	L. Dry Creek marsh north	8.0	18.3	15	0	0	0
5	L. Dry Creek north inlet	9.7	25.0	16	1	1	1
6	West shore	6.3	14.3	12	0	0	0
7	Dry Creek inlet south	10.3	30.7	16	2	0	2
8	Anthill drainage	9.3	24.7	15	0	0	1
9	Dry Creek east	10.3	31.0	20	0	1	0
10	Dry Creek west	7.3	17.7	15	0	0	0
11	Dry Creek inlet north	12.0	31.0	23	0	0	1
12	North shore	5.3	18.7	11	0	0	0
13	North inlet marsh	9.3	26.7	16	0	0	0
14	Coot Lake marsh north	10.3	27.7	19	0	0	0
15	Coot Lake marsh south	10.0	22.3	18	0	1	0
16	Coot Lake southeast	8.0	15.0	15	0	0	1
17	North dam drainage	8.0	28.0	15	0	0	1
18	South dam drainage	6.0	17.0	12	0	0	0
19	Marina/south dam	8.3	18.3	17	0	1	2
20	Dream Cove	11.7	53.3	21	0	0	2

¹ Colorado Natural Heritage Program. 2012. Tracked bird species.

² Hallock, D., and S. R. Jones. 2010. Boulder County avian species of special concern. Boulder County Nature Series: No. 1. Boulder County Nature Association, Boulder, Colorado.

³ Species nesting at significantly higher densities within urban and rural residential areas than in other areas of Colorado (Kingery. 1998).

Table 7. Breeding Season (June-July) Point-Count Summary Detail

Point No.	Location	Dominant Habitats ¹	Mean Ind. ²	% CNHP Tracked ³	% Urban-adapted ⁴	% Non-Native ⁵
1	L. Dry Creek south inlet	Emergent marsh, shoreline, open water, riparian woodland, rural residential	29.7	0.0	34 .4	1.1
2	L. Dry Creek overlook	Mixed prairie, emergent marsh, shoreline, open water, barren ground	40.0	0.8	58 .6	4.3
3	L. Dry Creek marsh south	Emergent marsh, riparian woodland, mixed prairie	18.7	0.0	12.5	0.0
4	L. Dry Creek marsh north	Emergent marsh, mixed prairie	18.3	0.0	18.2	0.0
5	L. Dry Creek north inlet	Emergent marsh, mixed prairie, riparian woodland	25.0	0.0	13.3	1.3
6	West shore	Open water, shoreline, riparian woodland, mixed prairie	14.3	0.0	4.7	0.0
7	Dry Creek inlet south	Shoreline, riparian woodland, emergent marsh	30.0	0.0	44.6	1.1
8	Anthill drainage	Emergent marsh, mixed prairie, riparian woodland	24.7	0.0	12 .0	10.7
9	Dry Creek east	Emergent marsh, rip. woodland, shoreline, mixed prairie	31.0	0.0	14 .3	0.0
10	Dry Creek west	Emergent marsh, mixed prairie	17.7	0.0	9 .7	0.0
11	Dry Creek inlet north	Shoreline, open water, emergent marsh, riparian, mixed prairie	31.0	0.0	20 .7	0.0
12	North shore	Open water, shoreline, riparian woodland	18.7	0.0	12 .1	0.0
13	North inlet marsh	Riparian, emergent marsh, mixed prairie	26.7	0.0	13 .8	0.0
14	Coot Lake north	Riparian, emergent marsh, agricultural, barren ground	27.7	0.0	7.4	0.0

Point No.	Location	Dominant Habitats	Mean Individ.	% CNHP Tracked	% Urban-adapted	% Non-Native
15	Coot Lake marsh south	Emergent marsh, barren ground, riparian woodland	22.3	0.0	8.0	0.0
16	Coot Lake southeast	Open water, shoreline, barren ground, riparian woodland	15.0	0.0	42.2	4.4
17	North dam drainage	Emergent marsh, mixed prairie	28.0	0.0	5.9	2.4
18	South dam drainage	Mixed prairie, alkali marsh, barren ground	17.0	0.0	12.2	0.0
19	Marina/south dam	Open water, shoreline, barren ground, rural, riparian woodland	18.3	0.0	43.6	9.1
20	Dream Cove	Open water, shoreline, riparian woodland, barren ground	53.3	0.0	70.4	1.2

¹ Habitats present within 200 m radius of point-count station.

² Mean individuals per survey.

³ Colorado Natural Heritage Program. 2012. Tracked bird species.

⁴ Species nesting at significantly higher densities within urban and rural residential areas than in other areas of Colorado (Kingery. 1998).

⁵ Species not documented breeding in Colorado prior to 1900 (Henderson 1908, Sclater 1912, Kingery 1998).

Though we observed a few Horned Larks, Vesper Sparrows, Lark Sparrows, Grasshopper Sparrows, and several dozen Western Meadowlarks around the reservoir, breeding densities of these grassland-nesting species appear to be low compared to densities in more natural prairies east of Boulder County (Kingery 1998). Grasslands surrounding Boulder Reservoir are dominated by non-native grasses and may provide poor nesting structure and foraging opportunities for most grassland-nesting birds.

Migratory Bird Concentration Areas

Tables 8-9 summarize results of point counts conducted during the April-May spring migration season. Plots 7 and 11, which lie on the shoreline of the Dry Creek/North inlet, supported the highest mean numbers of species and individuals, as well as the most total species (Table 9). These plots also supported relatively low percentages of urban-adapted and non-native species. Plots 1-5, in the Dry Creek marsh and Little Dry Creek north and south inlets, supported substantially lower mean numbers of species and individuals, along with substantially fewer total species and higher percentages of urban-adapted and non-native species.

Table 8. Spring migration (April-May) point-count summary. Counts conducted on 23-25 April and 12-14 May.

Point No.	Location	Mean Species	Mean Individuals	Total Species	CNHP Tracked ¹	BCNA Concern ²	Non-Native ³
1	L. Dry Creek south inlet	8.0	22.5	11	0	0	2
2	L. Dry Creek overlook	5.5	12.0	9	0	0	1
3	L. Dry Creek marsh south	6.5	15.5	12	0	0	0
4	L. Dry Creek marsh north	5.5	16.0	8	0	0	0
5	L. Dry Creek north inlet	5.0	17.5	9	0	1	0
6	West shore	5.0	7.5	10	0	0	0
7	Dry Creek inlet south	11.0	29.5	20	2	0	1
8	Anthill drainage	5.0	15.5	8	0	0	0
9	Dry Creek east	5.0	14.5	8	0	0	1
10	Dry Creek west	4.5	16.5	7	0	0	0
11	Dry Creek inlet north	9.0	29.0	15	1	0	0
12	North shore	3.0	12.0	6	0	0	0
13	North inlet marsh	7.5	16.5	12	0	0	1
14	Coot Lake marsh north	8.0	22.0	13	0	1	0
15	Coot Lake marsh south	8.0	20.5	13	0	1	0
16	Coot Lake southeast	7.5	15.0	12	0	0	1
17	North dam drainage	6.5	29.0	10	0	1	0
18	South dam drainage	4.0	6.5	7	0	0	0
19	Marina/south dam	5.0	8.5	8	0	0	2
20	Dream Cove	9.0	18.0	14	0	0	0

Table 9. Spring migration (April-May) point-count detail.

Point No.	Location	Dominant Habitats ¹	Mean Ind. ²	% CNHP Tracked ³	% Urban-adapted ⁴	% Non-Native ⁵
1	L. Dry Creek south inlet	Emergent marsh, shoreline, open water, riparian woodland, rural residential	22.5	0.0	31.1	8.8
2	L. Dry Creek overlook	Mixed prairie, emergent marsh, shoreline, open water, barren ground	12.0	0.0	41.7	4.2
3	L. Dry Creek marsh south	Emergent marsh, riparian woodland, mixed prairie	15.5	0.0	9.7	0.0
4	L. Dry Creek marsh north	Emergent marsh, mixed prairie	16.0	0.0	15.6	0.0
5	L. Dry Creek north inlet	Emergent marsh, mixed prairie, riparian woodland	17.5	0.0	14.3	0.0
6	West shore	Open water, shoreline, riparian woodland, mixed prairie	7.5	0.0	0.0	0.0
7	Dry Creek inlet south	Shoreline, riparian woodland, emergent marsh	29.5	39.9	3.4	0.0
8	Anthill drainage	Emergent marsh, mixed prairie, riparian woodland	15.5	0.0	3.2	0.0
9	Dry Creek east	Emergent marsh, rip. woodland, shoreline, mixed prairie	14.5	0.0	3.4	3.4
10	Dry Creek west	Emergent marsh, mixed prairie	16.5	0.0	3.4	0.0
11	Dry Creek inlet north	Shoreline, open water, emergent marsh, riparian, mixed prairie	29.5	6.9	3.4	6.8
12	North shore	Open water, shoreline, riparian woodland	12.0	0.0	54.1	0.0
13	North inlet marsh	Riparian, emergent marsh, mixed prairie	15.5	0.0	30.3	12.1
14	Coot Lake north	Riparian, emergent marsh, agricultural, barren ground	22.0	0.0	29.5	0.0
15	Coot Lake marsh south	Emergent marsh, barren ground, riparian woodland	20.5	0.0	24.4	0.0

Point No.	Location	Dominant Habitats	Mean Individ.	% CNHP Tracked	% Urban-adapted	% Non-Native
16	Coot Lake Southeast	Open water, shoreline, barren ground, riparian woodland	15.0	0.0	37.0	3.3
17	North dam drainage	Emergent marsh, mixed prairie	29.0	0.0	41.7	2.4
18	South dam drainage	Mixed prairie, alkali marsh, barren ground	6.5	0.0	13.1	0.0
19	Marina/south dam	Open water, shoreline, barren ground, rural, riparian woodland	8.5	0.0	52.9	11.8
20	Dream Cove	Open water, shoreline, riparian woodland, barren ground	18.0	0.0	55.5	0.0

To better document the differences among water-dependent bird populations within these two drainages and three inlets, I conducted 10-minute counts of all ducks, grebes, waders, and shorebirds observed within the inlets (from the shoreline eastward to the buoys separating the inlets from the rest of the reservoir) from points 1 and 2, 5 and 6, and 7 and 11 during each of four bird surveys in May, June and July (Table 10). During these surveys, I observed a total of 21 waterfowl, heron, and shorebird species within the Dry Creek inlet compared to only 8 within the Little Dry Creek north inlet and only 7 within the Little Dry Creek south inlet. Birds observed within the Dry Creek inlet included two Colorado Natural Heritage Program tracked species (American White Pelican and White-faced Ibis), and a Boulder County Nature Association species of special concern (Great Egret).

Characteristics which may attract more waterfowl, herons, and shorebirds to the Dry Creek inlet than to the Little Dry Creek inlets include a gradually sloping shoreline, presence of extensive mud flats and a significant area of shallow water offshore, and presence of native shrubs and sedge/rush wetlands close to the shoreline. Summer aerial photos of this inlet from Google Earth show a plume of brownish silt emanating from the mouth of Dry Creek and spreading out across most of the inlet, whereas no such silt plume appears on comparable aerial photos of the Little Dry Creek north and south inlets.

In 1987 the City of Boulder, acting in consultation with the Boulder County Nature Association, installed check dams across formerly channelized Little Dry Creek upstream from North 51st Street to create a new cattail marsh. This marsh, another marsh along Dry Creek west of North 53rd Street, and the wetlands west of Coot Lake were created to mitigate for loss of wetlands resulting from hardening of the Boulder Reservoir spillway and a consequent raising of the reservoir water level by up to 4 feet. It's possible that the diversion of water flows from formally channelized Little Dry Creek into the newly created marshes eliminated much of the flow of silt from this creek into the reservoir inlets, indirectly leading to a steepening of shoreline areas or deepening of near-shoreline waters.

Table 10. Mean number of of ducks, waders, and shorebirds observed in three west shore inlets during four May, June, and July 2013 bird surveys.¹

Species	Dry Creek Inlet	Little Dry Creek North Inlet	Little Dry Creek South Inlet
Canada Goose	5.3	4.3	13.3
Gadwall	0.8		
Mallard	7.5	0.8	12.0
Blue-winged Teal	1.3		
Cinnamon Teal	0.3		
American Wigeon	0.8		
Northern Shoveler	0.5		
Northern Pintail	0.8		
Green-winged Teal	1.3		
Western Grebe	0.8	0.5	0.5
Clark's Grebe	0.3		
Double-crested Cormorant	0.5	0.8	
American White Pelican	2.3	1.0	0.8
Great Blue Heron	0.3		0.3
Great Egret	0.5		
White-faced Ibis	4.5		
Semipalmated Plover	0.5		
Killdeer	0.8	1.3	1.3
American Avocet	1.5		
Spotted Sandpiper	5.3	1.8	0.8
Baird's Sandpiper	0.5	0.5	

¹ Mean number per survey. Dry Creek 13 May, 12 June, 29 June, 13 July; Little Dry Creek north 14 May, 10 June, 29 June, 11 July; Little Dry Creek south 14 May, 12 June, 27 June, 11 July.

In addition, the presence of two Osprey nesting platforms on poles within 50 m of the shorelines of the Little Dry Creek inlets may discourage ducks and shorebirds from foraging there. Though Ospreys prey primarily on fish, they are opportunistic feeders and may harass foraging ducks and shorebirds (Poole, Bierregard, and Martel 2003).

Boulder County birdwatchers reported seeing Blue-winged Teal and Cinnamon Teal in the Little Dry Creek south inlet during most summers prior to 1990 (G. Brown, pers. comm.; Boulder County Audubon Society 1979-2013). These two native dabbling ducks typically nest in shoreline areas of shallow marshes, and they typically forage in waters shallow enough to enable them to tip their bodies and glean invertebrates and plants from the bottom (Boyle 1998, Kuenning 1998). Numbers of Boulder County Monthly Wildlife Inventory reports of these two species from Boulder Reservoir declined sharply after 1990 (Boulder County Audubon Society 1979-2013).

During April and May migratory bird surveys we also saw up to 75 geese, ducks, grebes, waders, and gulls floating on Coot Lake or wading near shore. Species observed included Canada Goose, Wood Duck, Gadwall, American Wigeon, Mallard, Redhead, Lesser Scaup, Greater Scaup, Common Merganser, Eared Grebe, Western Grebe, Clark's Grebe, Great Blue Heron, American Coot, and Ring-billed Gull. Most of these birds had departed by the first week of June, and of them only Canada Goose and Mallard appeared to nest within the Coot Lake wetlands.

Species of Special Concern

Wetlands on the west side of Boulder Reservoir and west of Coot Lake have been designated as Critical Wildlife Habitat in the Boulder County Comprehensive Plan due to the presence there of nesting American Bitterns (Boulder County isolated and restricted), Ospreys (Boulder County isolated and restricted), and Northern Harriers (Boulder County rare and declining; Hallock and Jones 2010).

During 2013 we identified three American Bittern nesting territories within the Dry Creek marsh area east and west of North 51st Street and a fourth American Bittern nesting territory in the Coot Lake wetlands (Figure 2). We detected no American Bitterns in the Little Dry Creek drainage, where calling bitterns were observed annually from 2004-09 and 2011-12 (Figure 3; Table 11; Jones 2006-13). The total of seven American Bittern nesting territories documented within wetlands surrounding Boulder Reservoir from 2004-13 comprises at least half of all American Bittern nesting territories reported in Boulder County from 1980-2013 (Hallock and Jones 2010, Jones 2006-13).

Two Osprey pairs nested near the reservoir during 2013, one pair on an artificial nest platform located on a pole in the Little Dry Creek marsh east of North 51st Street and the second pair on an artificial nest platform located on a pole on the Boulder Open Space and Mountain Parks Axelson property 50 m west of North 51st Street (Figure 4; Table 12). Both nests failed, the Little Dry Creek nest in early June after two young had been observed on the nest, and the Dry Creek nest in early June during incubation. Ospreys nested successfully around the reservoir from 2001-13 (Jones 2006-13). Nest productivity has declined from an average of 4.0 young fledged/year from 2004-10 to 2.0 fledged/year from 2011-13.

We observed a pair of foraging Northern Harriers flying low over and occasionally descending into the Little Dry Creek and Dry Creek cattail marshes throughout April and early May. However, we saw no evidence of nesting, and we observed no Northern Harriers within the study area during June or July. This is the second consecutive year that we have found no evidence of nesting in the marshes west of Boulder Reservoir, where Northern Harriers nested annually from 2004-11 (Figure 5; Jones 2006-13).

Northern Harriers nested successfully in the Coot Lake wetlands in 2004 (4 young fledged), in the Little Dry Creek cattail marsh in 2004 (4 young fledged) and 2009 (4 young fledged), and in the Dry Creek cattail marsh in 2010 (3 young fledged; Table 13). These are the only successful Northern Harrier nests that have been documented in Boulder County since 1987 (Hallock and Jones 2010, Jones 2006-13), and this species is critically imperiled in Boulder County.

Figure 2. American bittern 2013 observation locations.



Figure 3. American Bittern 2006-13 suspected territories, with years suspected active.¹



¹ One or more calling bittern heard; or pair or fledged young seen during documented breeding season.

Figure 4. Osprey 2004-13 nest locations.

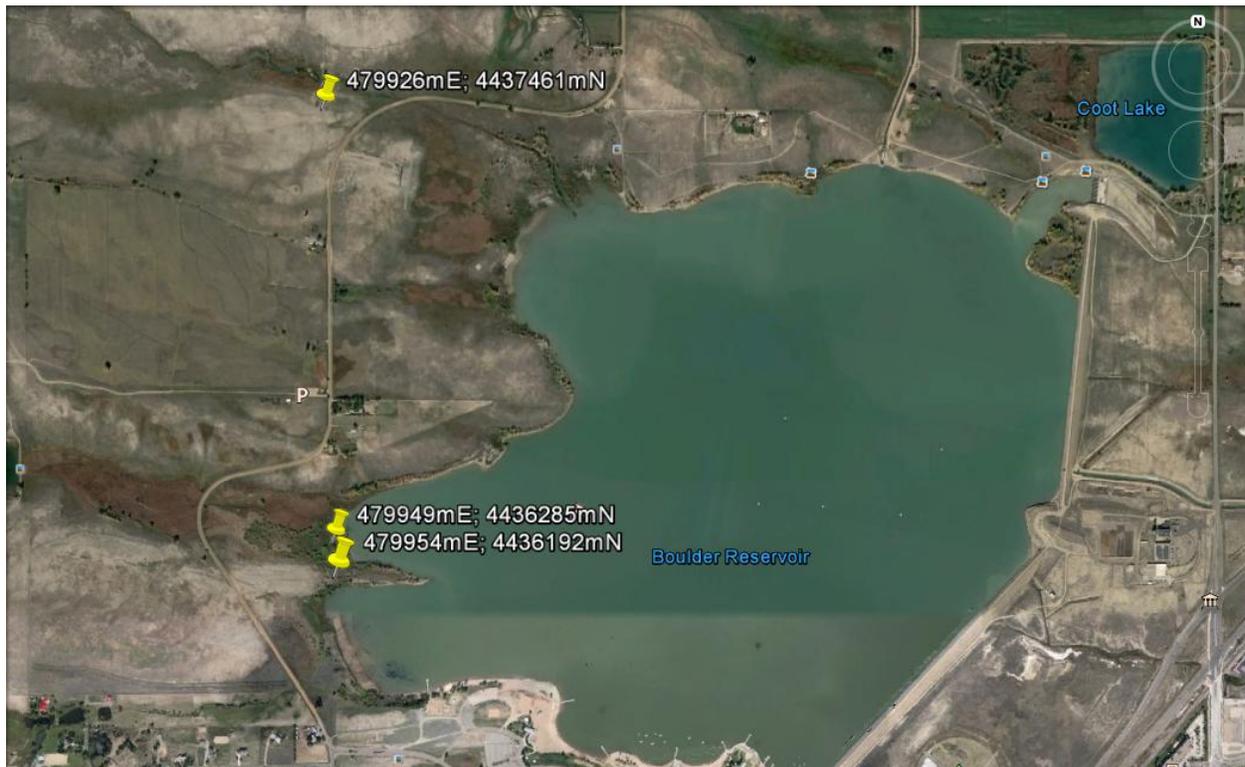


Table 11. American Bittern 2004-13 nesting observations at Boulder Reservoir and Coot Lake.¹

Year	Little Dry Creek	Dry Creek	Coot Lake
2004	Territory ²	Inactive ³	2 young observed
2005	Territory	Inactive	Territory
2006	Territory	Territory	Territory
2007	Territory	1 young observed	Territory
2008	Territory	Territory	Territory
2009	Territory	Territory	Inactive
2010	Inactive	2 young observed	Territory
2011	Territory	2 territories	Territory
2012	Territory/pair	2 territories	Territory
2013	Inactive	3 territories	Territory/pair observed

¹ Jones, S.R. 2006-13. Boulder Reservoir species of special concern monitoring reports. Boulder Parks and Recreation Department, 3198 Broadway, Boulder Colorado 80304.

² Territory indicated by persistent calling of male bittern.

³ No individuals seen or heard.

Table 12. Osprey 2004-13 nesting observations at Boulder Reservoir. ¹

Year	Little Dry Creek North Platform	Little Dry Creek South Platform	Dry Creek/Axelson
2004			2 young fledged
2005			2 young fledged
2006			2 young fledged
2007			4 young fledged
2008		3 young fledged	4 young fledged
2009	Nest failed	3 young fledged	3 young fledged
2010	Inactive	2 young fledged	3 young fledged
2011	Inactive	2 young fledged	Nest failed (incubation)
2012	3 young fledged	Canada Goose nest	Nest failed (incubation)
2013	Nest failed (2 young)	Canada Goose nest	Nest failed (incubation)

¹ Jones, S.R. 2006-13. Boulder Reservoir species of special concern monitoring reports. Boulder Parks and Recreation Department, 3198 Broadway, Boulder Colorado 80304.

Figure 5. Northern Harrier 2004-13 approximate nest locations.

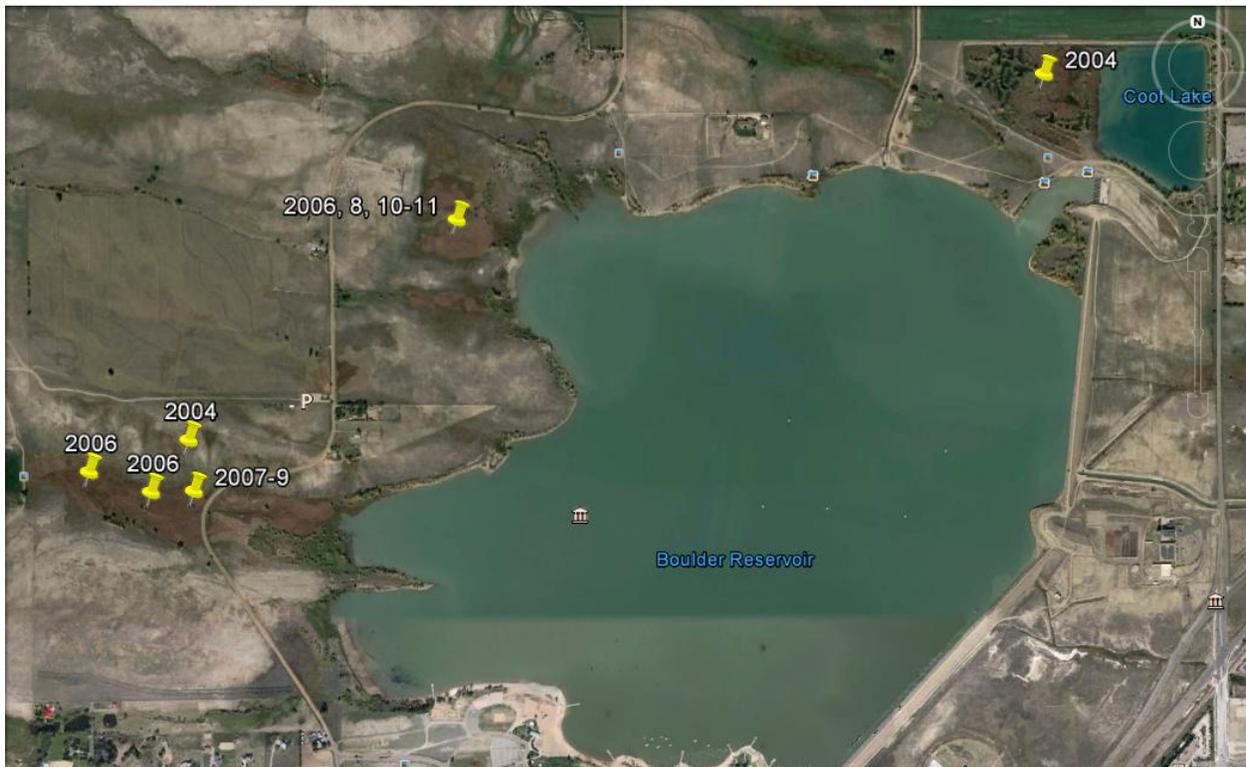


Table 13. Northern Harrier 2004-13 nesting observations at Boulder Reservoir and Coot Lake.¹

Year	Little Dry Creek	Dry Creek	Coot Lake
2004	4 young fledged	Inactive ²	4 young fledged
2005	Pair observed	Inactive	Pair observed
2006	2 nests failed	Nest failed	Inactive
2007	Nest failed	Inactive	Inactive
2008	Nest failed	Nest failed	Inactive
2009	4 young fledged	Inactive	Inactive
2010	Inactive	3 young fledged	Inactive
2011	Inactive	Nest failed	Inactive
2012	Inactive	Inactive	Inactive
2013	Pair observed/no nest	Inactive	Inactive

¹ Jones, S.R. 2006-13. Boulder Reservoir species of special concern monitoring reports. Boulder Parks and Recreation Department, 3198 Broadway, Boulder Colorado 80304.

² No pair, territorial activity, or other signs of nesting observed.

A review of nesting records for Boulder County species of special concern in wetlands west of the reservoir from 2004-13 reveals a tendency of American Bitterns and Northern Harriers to nest less frequently in the Little Dry Creek cattail marshes and more frequently in the more vegetatively complex marshes of the Dry Creek drainage (Figures 2 and 5; Jones 2006-13). Crowded cattail growth within the Little Dry Creek drainage may be eliminating other marsh types (such as sedge/rush meadows and open water) and inhibiting foraging and nesting opportunities for marsh-dependent birds.

We also observed Northern Bobwhites (Boulder County rare and declining), Eared Grebes (Boulder County rare and declining), Bald Eagles (Boulder County isolated and restricted), Long-billed Curlews (Boulder County extirpated breeding populations), a Loggerhead Shrike (Boulder County rare and declining), Grasshopper Sparrows (Boulder County isolated and restricted), and a Bobolink (Boulder County isolated and restricted) within the study area (Figures 6-8; Table 14). Suitable nesting habitat for all of these Boulder County birds of special concern exists within the study area, but we did not confirm nesting for any of them. Detailed species accounts for birds of special concern that have nested or seem likely to nest within the study area follow below.

American Bittern (Boulder County isolated and restricted, USFS sensitive)

American Bitterns lay their eggs on platform nests constructed in dense emergent vegetation or, less frequently, in dense grasslands (Gibbs, Melvin, and Reid 2009). North American nesting success appears highest within large unfragmented marshes (Gibbs, Melvin, and Reid 2009). As a result of fragmentation and loss of wetlands, along with pesticide contamination and human disturbance of marshes, North American breeding populations have declined significantly since 1966 (Kingery 1998, Gibbs, Melvin, and

Table 14. Colorado Natural Heritage Program tracked birds and Boulder County Nature Association/Boulder County Parks and Open Space birds of special concern observed during 2013 surveys.

Colorado Natural Heritage Program Global Ranking Codes: G3, vulnerable to extirpation or extinction; G4, widespread, abundant, and apparently secure; G5, demonstrably widespread, abundant, and secure; T, rank applies to subspecies or variety.

State Ranking Codes: S1, state critically imperiled; S2, state imperiled; S3, state rare or uncommon; S4, state apparently secure; B, breeding populations; N, non-breeding populations.

Species	CNHP ¹	BCNA/BCPOS ²	Federal/State	USFS/BLM	Boulder Reservoir Status
Northern Bobwhite	---	Rare and Declining	---	---	Rare; no documentation of nesting
Eared Grebe	---	Rare and Declining	---	---	Fairly common migrant; no documentation of nesting
American White Pelican	G3;S1B	---	---	BLM	Summer resident non-breeder
American Bittern	---	Isolated and Restricted	---	USFS Sensitive	Four to five breeding territories annually in wetlands near reservoir ³
Great Egret	---	Isolated and Restricted	---	---	Summer visitor; nests at St. Vrain State Park
White-faced Ibis	G5;S2B	---	---	BLM	Summer visitor; no documentation of nesting
Osprey		Isolated and restricted			Nests annually on west side of reservoir.
Northern Harrier	---	Rare and declining; isolated	---	USFS Sensitive	Nests occasionally in wetlands surrounding reservoir ⁴
Bald Eagle	G5;S1B,S3N	Isolated and restricted	State concern	USFS Sensitive	Summer resident; nest failed in 2007.
Long-billed Curlew	G5;S2B	Extirpated nesting species	State concern	USFS Sensitive	Seen 22 April and 10 May 2013; marginal nesting habitat exists.
Forster's Tern	G5;S2B,S4N	---	---	---	Summer resident non-breeder
Loggerhead Shrike	---	Rare and declining; isolated	---	USFS Sensitive	Seen 25 April 2013; suitable nesting habitat may exist
Grasshopper Sparrow	---	Isolated and restricted	---	USFS Sensitive	Singing males 13 May and 2 June; suitable nesting habitat exists
Bobolink	G5;S3B	Isolated and restricted	---	---	No nesting habitat within study area.

¹Colorado Natural Heritage Program. 2012. CNHP tracked bird species.

www.cnhp.colostate.edu/download/list/birds.asp

²Hallock, D., and S.R. Jones. 2010. Boulder County avian species of special concern. Boulder County Nature Association, www.bcna.org. Also included in Boulder County Comprehensive Plan.

³ Roughly half of the recently documented American Bittern nesting territories in Boulder County are in wetlands surrounding Boulder Reservoir (Hallock and Jones 2010, Jones 2006-12).

⁴ These nest sites, located in cattail marshes west and northeast of the reservoir, are the only documented successful Northern Harrier nesting sites in Boulder County since 1983 (Hallock and Jones 2010, Jones 2006-13).

Reid 2009). Sauer, Hines, and Fallon (2012) reported an annual rate of decline of nearly 1.8% from 1966-2011 on North American Breeding Bird Survey routes.

Strategies that increase the size of marshes and protect them from disturbance by humans and domestic dogs should benefit nesting bitterns. Although Boulder County populations appear to be stable (Hallock and Jones 2010), the species still appears limited to a dozen documented nesting sites in the county, and eight of these are in wetlands adjacent to Boulder Reservoir, privately-owned Six-Mile Reservoir, and Coot Lake. All of the known sites are in small (< 5 ha) cattail marshes near reservoirs or within floodplains, and most lie in areas that have been fragmented by mining, farming, roads, or trails.

All but one of the known sites (Six-Mile Reservoir) lie on public lands, but their vulnerability to urban-adapted predators and proximity to recreational trails may limit nesting success. Young bitterns are difficult to detect among the cattail foliage, and any attempt to count or band young would require disturbance of nesting areas. Therefore, it seems most prudent to continue to monitor sites from a non-intrusive distance, limit human encroachment within 200 m of any active nests, and strive to expand the areas of protected cattail marshes and surrounding wetlands.

White-faced Ibis (CNHP fully tracked, BLM tracked)

White-faced Ibis nest in scattered locations of eastern, southern, and northwestern Colorado in emergent wetlands often containing bulrushes and cattails (Ryder 1998). Breeding numbers vary dramatically from year to year depending on water levels in favored marshes (Ryder 1998).

We observed flocks of up to 75 White-faced Ibis flying over the Little Dry Creek drainage and wading in the shallows of the Dry Creek inlet during April and May. Cattail marshes within the Dry Creek drainage could provide suitable nesting habitat. However, there are no historical nesting records for White-faced Ibis anywhere in Boulder County, and the closest recently-documented nesting site is at Lower Latham Reservoir, 50 km northeast of the study area (Hallock and Jones 2010, Ryder 1998).

Osprey (Boulder County isolated and restricted)

Ospreys were first observed nesting near Boulder Reservoir in 1998 (Jones 2006-13). Though they nested historically in the mountains of the Colorado Front Range, there was no documentation of nesting on the plains of Boulder County before the mid-1990s (Hallock and Jones 2010). They have nested at four locations within 2 km of Boulder Reservoir (Figure 4):

1. Two artificial nest platforms erected on abandoned telephone poles by Boulder Parks and Recreation Department staff within the Little Dry Creek marsh area between North 51st Street and the reservoir shoreline .

2. An artificial nest platform erected by Boulder Parks and Recreation and Boulder Open Space and Mountain Parks staff on the Axelson Open Space property south of Dry Creek and approximately 50 m west of North 53rd Street.

3. An artificial nest platform on an abandoned telephone pole on the North Rim Open Space property approximately 1 km northwest of North 53rd Street.

4. A new nest, established in July 2013, on an active telephone line 80 m east of North 51st Street and 1.5 km south of the Boulder Reservoir entrance station. This nest was removed by Excel Energy shortly after it was constructed (Joy Master, Boulder Parks and Recreation, pers. comm.).

From 2004-10, the three nesting sites closest to the reservoir (the two platforms at Little Dry Creek and the platform near Dry Creek) fledged a total of 28 young. The Axelson/Dry Creek site was particularly productive, fledging 20 young from 2004-10. From 2011-13, these sites fledged only 5 young.

During 2013, all four active nests failed. The North Rim and Axelson nests apparently failed during incubation, the Little Dry Creek north site after we observed two chicks on the nest in early June, and the new site south of the reservoir failed when the nest was taken down by Excel Energy. The Little Dry Creek south platform was appropriated by a pair of Canada Geese during 2012-13. Reasons for nest failures at the previously productive Axelson site during 2011-13 are unknown, but it's possible that one of the original pair died and its replacement is either less fertile or less skilled at defending or provisioning a nest. The Little Dry Creek sites fledged 8 young during 2004-10 and 5 young during 2011-12 (Jones 2006-13).

Nest monitors noted one instance of a hiker illegally entering the Little Dry Creek wildlife closure area and flushing one of the Ospreys off the nest in May (see Management section for details). Monitors noted no instances of direct disturbance of the Dry Creek Osprey nest. However, while engaging in bird surveys, we frequently saw photographers parking illegally at the turn in the road to photograph the nest. Colorado State Parks and Wildlife recommends nest buffers (no human activity or occupation) of 400 m around active Osprey nests (Colorado Division of Wildlife 2008). This is not possible at Boulder Reservoir, since North 51st Street passes within 150 m of two nests and North 53rd Street (the northern continuation of North 51st) within 50 m of a nest. However, nesting Ospreys can habituate to human activities better than many other raptor species (Poole, Bierregard, and Martel 2003), so the current wildlife closure areas may be sufficient to protect nesting pairs.

Ospreys typically arrive at the reservoir in March and begin nest building in April. The following nesting chronology, based on observations at Boulder Reservoir from 2006-13, can inform decisions about seasonal closures:

Nest building: 20 March-30 July
Incubation: 5 April-11 June
Visible young on nest: 13 May-20 July
Fledged young: 26 July-12 August

I don't recommend that additional Osprey nesting platforms be erected on Boulder Parks and Recreation managed lands surrounding the reservoir. Though Ospreys prey primarily on fish, they are opportunistic feeders (Poole, Bierregard, and Martel 2003) and their presence close to the reservoir shoreline may discourage foraging and nesting by native waterfowl and shorebirds.

Northern Harrier (Boulder County rare and declining, USFS sensitive)

We began annual monitoring of nesting Northern Harriers within the study area in 2004, and 2012 and 2013 were the first years when we observed no evidence of attempted nesting (Table 13). Successful nesting occurred in the Coot Lake wetlands in 2004 (4 young fledged), in the Little Dry Creek wetlands in 2004 (4 young fledged) and 2009 (4 young fledged), and in the Dry Creek wetlands in 2010 (3 young fledged). Unsuccessful nesting occurred in the Little Dry Creek wetlands in 2005 and 2007-8 and in the Dry Creek wetlands in 2006, 2008, and 2011. The total of only 19 young fledged from all these nesting attempts since 2004 is probably not enough to sustain a viable nesting population (Johnsgard 1990).

In Boulder County Northern Harriers typically build their platform nests on the ground in cattail marshes. They were considered a "fairly common" local nesting species during the first decade of the 19th century (Henderson 2008), but their numbers appear to have dwindled steadily since then (Alexander 1937, Boulder County Audubon Society 1979-2013, Hallock and Jones 2010). The only Northern Harrier nests documented in Boulder County since 1979 have been in the cattail marshes west of Boulder Reservoir and west of Coot Lake and in a small cattail marsh west of Lagerman Reservoir. Only the Boulder Reservoir and Coot Lake nests have fledged young (Hallock and Jones 2010).

Nesting populations have also declined throughout many regions of North America. The North American Breeding Bird Survey (Sauer et. al. 2012) reported a 2% annual decline in Northern Harrier observations from 1966-2011 throughout the shortgrass and mixed-grass prairie region of the Great Plains. Fragmentation of wetland breeding habitats by agriculture, along with poisoning of rodent prey populations by herbicides and pesticides have probably contributed to this decline (Smith et. al. 2011).

It's likely that fragmentation of potential nesting habitat by roads, agriculture, and other human activities severely limits Northern Harrier nesting opportunities and nesting success in Boulder County. Nests situated in smaller, fragmented marshes may be more susceptible to predation by carnivores and raptors (Smith et. al. 2011). We've often observed coyotes nosing around Northern Harrier nesting areas west of the reservoir and Red-tailed Hawks harassing nesting harriers (Jones 2006-13).

Northern Harriers are considered fairly common in Boulder County during winter (Boulder County Audubon Society 2011), and during winters of 2004-13 as many as 15 harriers were observed roosting communally on the ground in cattail marshes west of the reservoir (Ted Floyd, pers. comm.). During the winter of 2012 only 1-2 roosting harriers were reported in these marshes (Boulder County Audubon Society 1979-2013). We suspect that low prey populations may have discouraged harriers from wintering in this area, and may also have discouraged them from nesting.

During April and May 2013, we observed what appeared to be a single pair hunting over marshes in the Little Dry Creek and Dry Creek drainages. This pair was observed by various monitors in May, but there were no reported observations in June or July. Low populations of Meadow Voles and other rodent prey, along with harassment by potential predators, may have discouraged harriers from nesting in these marshes during 2012-13.

Based on recent observations, Northern Harrier appears to be the most endangered nesting bird species in Boulder County (see Hallock and Jones 2010). Therefore, every conceivable effort should be undertaken to protect and expand potential nesting areas. Colorado State Parks and Wildlife give no specific nest buffer recommendation for this species, but they recommend nest buffers of 400 m (no surface occupancy beyond what historically occurred in the area) for similar-sized Swainson's Hawks, and 800 m buffers for Peregrine Falcon, Prairie Falcon, and Goshawk (Colorado Division of Wildlife 2008). So a 400 m buffer would seem a reasonable minimal guideline for Northern Harriers, especially since they are ground nesters particularly vulnerable to disturbance by roaming hikers and dogs.

In instances when pairs may choose to nest within 400 m of existing trails or other recreational facilities, seasonal closures of those facilities will contribute to nesting success. Raptors may be more inclined to abandon nesting sites during the nest-building and early incubation periods than during the chick-rearing period. In other words, their fidelity to the nest often increases as the chances of successfully fledging young increases (Colorado Division of Wildlife 2008; Craighead and Craighead 1965). The Northern Harrier nesting chronology, below, based on observations at Boulder Reservoir from 2006-13, can inform decisions about seasonal closures:

- Nest building: 12 April-14 June
- Incubation: 12 May-26 July
- Feeding young on the nest: 25 May-7 July
- Fledged (independently flying) young: 10 July-15 August

Encroachment by hikers and their dogs into the closed area surrounding the Dry Creek Northern Harrier nesting site was reported on several occasions by volunteers during the 2012 and 2013 nesting seasons (see Management section for details). Better enforcement of this closure would benefit nesting Northern Harriers, as would efforts to restrict human traffic passing near the Little Dry Creek and Dry Creek wetlands to the existing road right-of-way. Dogs should be leashed throughout the Northern Harrier nesting season (or until observations determine that harriers aren't nesting at the site) on the trail encircling the wetlands west of Coot lake. In addition, Boulder Parks and Recreation could meet

with Boulder Open Space and Mountain Parks to discuss possible ways of expanding the extent of marsh area within the Dry Creek wetland, both upstream and downstream from N. 53rd St.

Bald Eagle (Boulder County isolated and restricted, State concern, CNHP fully tracked, USFS sensitive)

Bald Eagles have been observed every winter at Boulder Reservoir since at least 1979 (Boulder County Audubon Society 1979-2013, Boulder County Nature Association 2012). In March 2007 a pair began constructing a nest on the Osprey nesting platform on the Axelson open space property 50 m west of North 53rd Street. This pair was displaced by a pair of nesting Ospreys by early April.

Bald Eagles were first documented nesting in Boulder County in 2002, and six pairs nested within the county in 2013 (Hallock and Jones 2010, Boulder Open Space and Mountain Parks 2013). Suitable nesting habitat (cottonwood groves within proximity to open water) exists within the study area.

Long-billed Curlew (Boulder County extirpated breeding populations, State concern, CNHP fully tracked, USFS sensitive)

Long-billed Curlews nested in Boulder County during the late 19th century (Henderson 1908), before most native prairies in the county were destroyed or severely fragmented by agricultural operations and urban growth. However, a few individuals still pass through the county during spring migration. We observed at least five Long-billed Curlews within the study area in April and May 2013 (Figure 7).

Long-billed Curlews typically nest in mixed-grass prairies close to shallow ponds or mud flats, where there is adequate cover for concealing their ground nests and barren ground where they can forage for invertebrates. They are considered an indicator of healthy native grasslands (Nelson 1998). Restoration of mixed-grass prairies surrounding Boulder Reservoir and Coot Lake to native grasses could create suitable nesting habitat for this species.

Burrowing Owl (Boulder County isolated and restricted, State threatened, USFS sensitive)

We observed no Burrowing Owls within the study area during 2013. Burrowing Owls nested successfully in the prairie dog colony east of the north dam and south of Coot Lake in 1988, 1989, and 2004; on the Boulder Reservoir north shore in 1982-3; and on the Axelson property northwest of Boulder Reservoir in 1986, 2007, and 2012 (Figure 7; Table 16; Jones and Mahoney 2003, Jones 2006-13).

Low fledge rates of nests during the past 20 years (Jones and Mahoney 2003, Boulder County Nature Association unpublished data) suggest that high mortality of young owls, possibly caused by predation, has contributed to low burrowing owl numbers throughout the county. A total of 46 nesting attempts observed within Boulder County from 2008-12 produced only 113 visible young (Table 17). This nest productivity is significantly below that reported for other High Plains burrowing owl populations (Johnsgard 1999) and may not be sufficient to maintain viable nesting populations.

Figure 6. Long-billed Curlew 2013 observation locations.



Figure 7. Burrowing Owl 2004-13 nest and sighting locations.

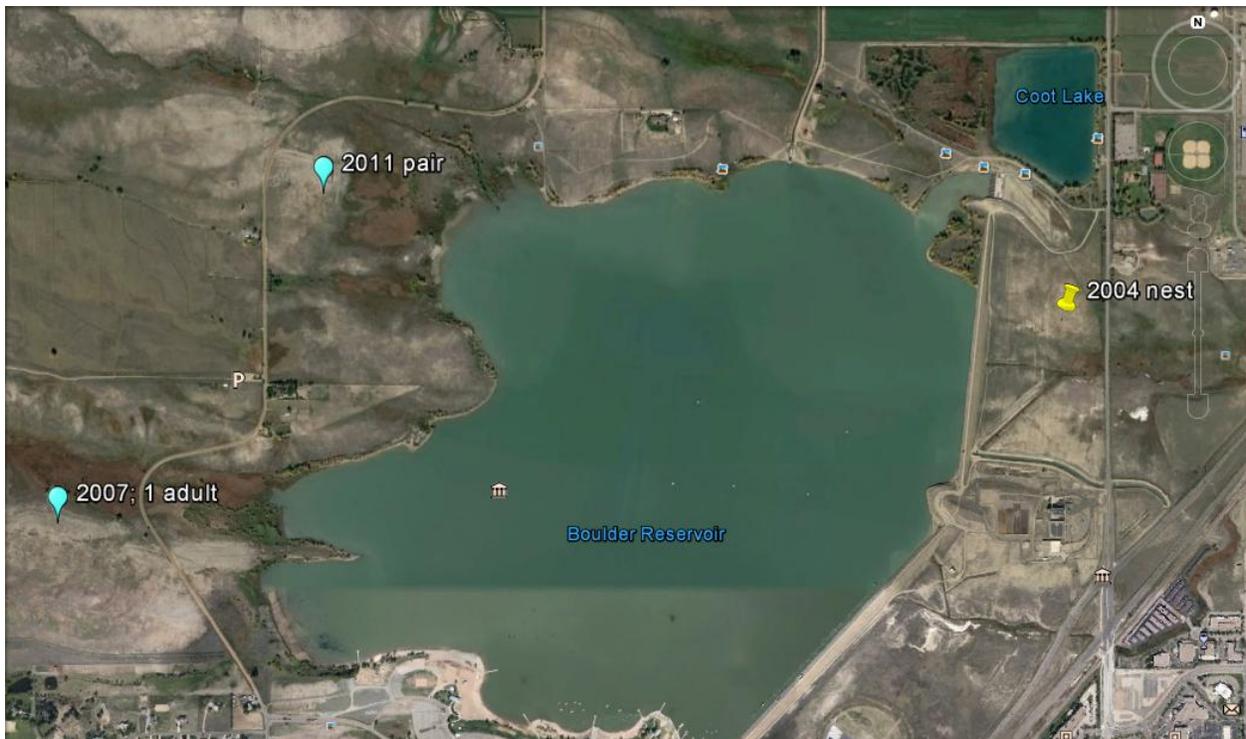


Table 15. 2004-13 Burrowing Owl observations. ¹

Year	Little Dry Creek	Dry Creek	North Dam
2004	Inactive ²	Inactive	Nest with 3 young
2005	Inactive	Inactive	1 adult seen, 14 April
2006	Inactive	Inactive	Inactive
2007	1 adult seen	Inactive	Inactive
2008	Inactive	Inactive	Inactive
2009	Inactive	Inactive	Inactive
2010	Inactive	Inactive	Inactive
2011	Inactive	Pair, 16-20 April	Inactive
2012	Inactive	Inactive	Inactive
2013	Inactive	Inactive	Inactive

¹ Jones, S.R. 2006-13. Boulder Reservoir species of special concern monitoring reports. Boulder Parks and Recreation Department, 3198 Broadway, Boulder Colorado 80304.

² No pair, territorial activity, or other signs of nesting observed.

Though suitable nesting habitat (moderate to large-sized, active prairie dog colonies) for Burrowing Owls exists within the study area, this species is doing poorly throughout Boulder County, where nesting productivity may be limited by nesting habitat fragmentation and predation by urban-adapted carnivores (Hallock and Jones 2010, Jones 2012, Jones and Mahoney 2003).

Table 16. Burrowing Owl Nesting Success in Boulder County, 2007-12. Nesting attempts/total young observed.

Years	Boulder County Parks and Open Space ¹	Boulder Open Space and Mountain Parks ²	Boulder Parks and Recreation ³	Total
2008	NA	7/22	0/0	NA
2009	5/9	6/7	0/0	11/16
2010	5/12	5/10	0/0	10/22
2011	3/15	6/18	0/0	9/33
2012	6/9	3/11	0/0	9/20
2013	1/4		0/0	

Protection and conservation of prairie dog colonies around the reservoir may contribute to future burrowing owl nesting success, especially if prairie dog colonies are relatively large and buffered from disturbance. A variety of studies conducted on the Great Plains and in the Great Basin have determined that burrowing owl nesting success is positively correlated with the size of prairie dog colonies and the density of active burrows within colonies (Desmond, Savidge, and Eskridge 2000; Lantz, Smith, and Keinath 2004); and negatively correlated with the degree of fragmentation of grassland habitat and

proximity of human activity to existing nests (Haug 1985, Hughes 1993, Pezolesi 1994, Desmond, Savidge, and Eskridge 2000).

Burrowing Owls nesting in smaller prairie dog colonies appear more vulnerable to predation and have fewer potential nesting burrows to choose from (Desmond, Savidge, and Eskridge 2000; Lance, Smith, and Keinath 2004). In addition, larger numbers of Burrowing Owls nesting in larger prairie dog colonies may gain an advantage over predators through increased vigilance. American Badgers, Coyotes, Red Foxes, Red-tailed Hawks, and Great Horned Owls are considered significant predators of Burrowing Owls (Lance, Smith, and Keinath 2004). Automobiles also kill burrowing owls. Over a five-year period during the 1990s, 26 of 28 injured burrowing owls admitted to the Birds of Prey Rehabilitation Foundation in Broomfield, Colorado, had been struck by cars (Sigrid Ueblacker, pers. comm.).

No researchers have attempted to set a minimal or optimal size of prairie dog colonies used successfully for nesting by Burrowing Owls, but Lance, Smith, and Keinath (2004) identified the following indicators of suitable nesting habitat:

1. Open, dry, treeless areas on grasslands, shrublands, and desert floors.
2. Gentle slopes, short vegetation, high percentages of bare ground.
3. High densities of burrows.
4. Current activity of burrowing mammals, primarily prairie dogs.
5. Close proximity to other nesting Burrowing Owls
6. Dried manure from cows, horses, or bison.

Lance, Smith, and Keinath (2004) also synthesized a list of priorities for nesting burrowing owl habitat enhancement and conservation:

1. Maintain prairie dog colonies through landowner agreements and habitat management plans.
2. Designate 1/4-mile to 1/2-mile buffer zones around known Burrowing Owl nests where pesticide use, rodent control, and human disturbances are restricted.
3. Protect all known nest burrows, and retain prairie dog burrows as future nest burrows.
4. Maintain areas of short grass and open ground.
5. Do not eliminate prairie dogs and ground squirrels.
6. Avoid fragmenting habitat in known nesting areas. Roads, pipelines, plowing, and industrial developments will fragment burrowing owl nesting habitat and should be avoided in known nesting areas.
7. Delay spring mowing in hayfields until late July, avoid nighttime mowing, and space mowings widely apart throughout the season to allow higher likelihood of successful nesting.
8. Leave dirt berms along edges of cultivated fields.
9. Consider installing artificial nest burrows in areas where burrowing mammals have been exterminated and burrow availability has diminished.
10. Preserve rights-of-way, haylands, and uncultivated fields within 600 m of nests for foraging. Taller grasses may be grazed to attract primary burrowers such as prairie dogs.
11. Provide fresh cattle dung near nesting areas if dung is not available.

Colorado State Parks and Wildlife recommends no human occupancy or activity within 150 feet of active Burrowing Owl nests (Colorado Division of Wildlife 2008). Burrowing Owls typically arrive in Boulder County in April and begin nesting in late April or early May (Kingery 1998). The nesting chronology below, based on monitoring of Burrowing Owl nests on Boulder County Parks and Open Space properties from 2009-13 (Jones 2011-13), can inform decisions about seasonal closures:

Pairs first seen on territory: 15 April-9 May

Suspected incubation/brooding of young: 25 April-28 June

First visible young: 8 June-12 July

Young flying from natal burrow: 4 July-1 August

Loggerhead Shrike (Boulder County rare and declining, USFS sensitive)

Loggerhead Shrikes nest in shortgrass prairies throughout eastern Colorado and were considered common during the late 19th and early 20th century (Carter 1998). Their nesting habitat has been reduced by agricultural operations and nesting success has been impacted by pesticide poisoning of insect prey and collisions with automobiles (Ehrlich et. al. 1992). In Boulder County, known nesting has been documented during the past three decades (Hallock and Jones 2010).

We saw a single Loggerhead Shrike perched in a Russian-Olive in the small ravine that bisects the North dam north prairie dog colony on 24 April. We did not see any Loggerhead Shrikes on subsequent surveys. Small patches of shortgrass prairie nesting habitat exist within the study area, and as native prairies are restored and rehabilitated, opportunities for Loggerhead Shrike nesting should increase.

Grasshopper Sparrow (Boulder County isolated populations)

We heard Grasshopper Sparrows singing in mixed-grass prairies near the northeast corner of Coot Lake on 13 May and saw a pair in the same location on 2 June. Patches of suitable nesting habitat (bunch grasses interspersed with areas of bare ground) for Grasshopper Sparrows exist throughout the study area, so it's likely that they nest at least occasionally.

Bobolink (Boulder County isolated populations; CNHP fully tracked)

We observed a singing Bobolink (Boulder County isolated and restricted) on the fence separating Coot Lake from the open space property to the north on 2 June (Figure 8). In Colorado bobolinks nest primarily in irrigated hayfields and damp, grassy meadows. Isolated stalks of shrubs or forbs within the meadows serve as perch sites for singing males. Dense grassy cover around ground nests helps to conceal the nests from predators and enable adults to enter and exit the nests without being seen (Katempfer 1998).

Suitable nesting habitat (wet meadows) exists within the Dry Creek marsh, but no Bobolinks were seen or heard there, and Bobolinks have not been documented nesting within the study area.

Figure 8. Bobolink sighting location.



Rare Species

We observed a total of seven singing Dickcissels in clover and alfalfa meadows on Boulder Open Space and Mountain Parks property northwest of the reservoir and north of Coot Lake on 18 and 28 June, and a single singing male within the Coot Lake wetland on 28 June (Figure 8). During drought years on the southern and western plains, male Dickcissels occasionally irrupt into Boulder County, but nesting within the County has never been documented (Henderson 1908, Alexander 1937, Hallock and Jones 2010).

Figure 8. Dickcissel 2013 observation locations.



Management

Boulder Reservoir and its surrounding wetlands, grasslands, riparian woodlands, and shrublands support at least 224 species of breeding and migratory birds, including at least 12 potentially nesting Colorado Natural Heritage Program or Boulder County Nature Association birds of special concern. Health of wetlands on the west side of the reservoir and west of Coot Lake is particularly vital to regional bird populations, since these wetlands comprise the only recently successful Northern Harrier (Boulder County rare and declining) nest sites within Boulder County and support approximately half of recently documented American Bittern (Boulder County isolated and restricted) nesting territories (Hallock and Jones 2010). These wetlands also support nesting Ospreys (Boulder County isolated and restricted), foraging Bald Eagles (federal and state protected), foraging and potentially nesting White-faced Ibis (CNHP fully tracked), foraging American White Pelicans (state sensitive, CNHP fully tracked); nesting Blue-Winged Teal, Cinnamon Teal, Spotted Sandpipers, Soras, Virginia Rails, Common Yellowthroats, and Wilson's Snipe; and several dozen migratory duck, heron, and shorebird species. Therefore, protection and enhancement of these wetlands should be of primary importance.

Grasslands surrounding the reservoir tend to be dominated by non-native species and support relatively low populations of grassland-nesting birds. Enhancement of these grasslands through seeding of native grasses, removal of Russian-Olives and other invasive trees, and protection of restoration areas from prairie dogs should improve breeding conditions for native grassland-nesting birds.

Several small ravines cutting through the grasslands on the west, north, and east side of the reservoir support native shrub-nesting birds, including Common Yellowthroat, Yellow Warbler, Gray Catbird, Blue Grosbeak, and Bullock's Oriole. Removal of Russian-Olives and other non-native trees from these ravines, along with closing of social trails that fragment them, should also enhance habitat for native birds.

Management of visitor use poses a significant challenge, since Boulder Reservoir and Coot Lake are popular destinations for runners, bicyclists, dog-walkers and other recreationists; and since more than a dozen annual special events, including triathlons and half marathons, may draw thousands of visitors to the reservoir on weekends. While monitoring nesting birds of special concern in the Coot Lake, Dry Creek, and Little Dry Creek wetlands, volunteers observed frequent incursions of recreational users and their dogs into protected areas. These included the following:

1. Dogs running loose into the wetlands on the west side of Coot Lake. During April-May 2012 volunteers reported more than 30 instances of dogs off leash along the trail encircling the Coot Lake wetlands, which was clearly posted at the time as "on leash;" and three instances of dogs running into the wetland (Jones 2006-13). On 8 April Parks and Recreation Conservation Ecologist Joy Master (pers. comm.) reported that 17 of 19 groups walking their dogs on this trail were in violation of the leash requirement, and she saw two dogs running and swimming in the closed area.

2. Hikers and dogs walking along the shoreline in the closed area of the Dry Creek inlet. During May 2012 alone, bird monitors noted three instances of people and their dogs walking and playing along

the shore east of the Anthill, which lies in the middle of this wetland complex (Jones 2012). On 3 September 2013, while visiting the Dry Creek inlet area for just 20 minutes, I counted 10 hikers and 6 dogs within the closed area between the North Shore access trail and Dry Creek (see photos, Appendix I).

3. Hikers and dogs entering Little Dry Creek marsh east of North 51st Street. During May 2013, observers reported a hiker flushing a female Osprey off her nest while he was hiking illegally along the shoreline and an off-leash dog running through the Little Dry Creek prairie dog colony. Nesting Ospreys also appeared to increase alertness in response to loud music emanating from reservoir beaches (Jones 2006-13).

Since volunteer monitors visit the reservoir and Coot Lake for just a few hours per week during April-July, these anecdotal reports only hint at the extent of disturbance of nesting birds and other wildlife that may occur within closed areas. All of the wildlife closures are clearly posted with signs explaining the reasons for the restrictions. Therefore, it's likely that enhanced enforcement both of the closures and any on-leash requirements will be necessary to decrease the amount of disturbance of nesting wildlife within these wetlands and adjacent prairie dog colonies.

Management Recommendations

The following actions should improve nesting and foraging habitat for marsh-nesting, grassland-nesting, riparian nesting, and shrub-nesting birds--and particularly for birds of special concern--at Boulder Reservoir and on Boulder Parks and Recreation properties surrounding the reservoir:

1. Continue to protect marshes in the Little Dry Creek and Dry Creek drainages and in the Coot Lake wetlands from disturbance by recreational users and their pets. Continue to post these areas as sensitive wildlife habitat and prohibit all entry into them during the April-August nesting season. Require that dogs be leashed on trails passing around or close to these areas April-August.

2. Initiate autumn prescribed burns of cattail marshes in the Little Dry Creek drainage to reduce crowded and matted vegetation and provide space for other marsh vegetation. Consider using Bobcats or other relatively lightweight earth-moving equipment to create shallow ponds and gentle (50-75 cm above the summer high water level) knolls and serpentine ridges within these wetlands.

3. Work to restore grasslands surrounding the reservoir to a more natural condition. While continuing or accelerating the ongoing program of aggressive weed control, initiate annual seeding of native grasses and native forbs in disturbed areas where prairie dogs are not present. Use prairie dog fencing to protect these recently-seeded areas. Consider initiating spring burns on a rotational basis throughout grassland areas.

4. Develop a prairie dog management plan that includes goals for percentage occupancy (such as 10-25%) of grassland areas by prairie dogs; and establishes and maps prairie dog preserves, areas where prairie dogs will be tolerated but not encouraged, and areas from which prairie dogs will be actively removed.

5. Discourage visitor and off-leash dog incursion into wildlife habitat in the Dry Creek inlet area and along the reservoir north shore. Consider stronger enforcement of wildlife closures in this area

and/or establishing fees for using the north shore parking area (to counteract the tendency of more and more people to gravitate to this area to avoid the south shore entrance fees).

6. Close social trails around the reservoir north shore and Coot Lake. Re-institute the April-June (or until American Bittern or Northern Harrier young fledge) dogs-on-leash requirement for the trail encircling the Coot Lake wetlands.

7. Continue removal of Russian-Olives and other invasive tree species throughout the study area.

8. Continue using buoys to protect the Little Dry Creek and Dry Creek inlet waterfowl, heron, shorebird, and Osprey breeding and foraging areas from disturbance by recreational boaters April-August.

9. Continue annual monitoring of nesting success of Boulder County birds of special concern and Colorado Natural Heritage Program tracked species. Initiate a new program monitoring migrating and wintering water bird populations at the reservoir.

10. Continue the current, thoughtfully-executed program of posting informational and educational signs notifying users of the importance of Boulder Reservoir wetlands and grasslands to birds of special concern. Assign rangers to actively enforce closures and to educate the public about their importance.

Table 17. Restoration opportunities and management recommendations by management zone.

Management Zone	Characteristics	Conservation/Restoration Opportunities	Management Recommendations
Coot Lake and Wetlands	<ol style="list-style-type: none"> 1. American Bittern and Northern Harrier nesting habitat. 2. Marsh-nesting habitat for native songbirds. 3. Foraging and resting habitat for migratory ducks and shorebirds. 4. Extensive areas of bare and weed-infested ground along existing trails. 5. High levels of recreational use and high numbers of off-leash dogs throughout year. 	<ol style="list-style-type: none"> 1. Enhance protection of nesting habitat from disturbance by humans and their pets throughout April-August nesting season. 2. Improve marsh-nesting songbird habitat by removing non-native vegetation. 3. Diminish areas of trampled ground and invasive weeds surrounding lake and marsh. 	<ol style="list-style-type: none"> 1. Re-institute the dogs-on-leash regulation on trail surrounding marsh April-June (continuing until young bitterns or harriers have fledged). Heighten enforcement of dog regulations. 2. Continue removal of Russian-Olives and other non-native trees from marsh area. 3. Close social trails and erect fences or rock barriers to discourage users and their pets from wandering off trail. 4. Continue annual monitoring of nesting birds of special concern.
Dry Creek and Shoreline	<ol style="list-style-type: none"> 1. Critical nesting habitat for American 	<ol style="list-style-type: none"> 1. Enhance protection of critical nesting habitat from 	<ol style="list-style-type: none"> 1. Continue to preclude off-trail and off-road hiking

	<p>Bittern and Northern Harrier. Osprey nesting and foraging habitat.</p> <p>2. Great Blue Heron nesting colony.</p> <p>3. High-quality habitat for marsh-nesting and riparian-nesting songbirds.</p> <p>4. Shoreline and marsh habitat for foraging and nesting ducks, herons, and shorebirds, including several species of local and state concern.</p> <p>5. Degraded breeding habitat for grassland-nesting birds.</p>	<p>wandering hikers and dogs.</p> <p>2. Improve marsh-nesting and riparian-nesting habitat by controlling weeds and removing non-native trees.</p> <p>3. Improve protection of inlet foraging and nesting areas from wandering hikers and dogs.</p> <p>4. Restore degraded upland prairies to native prairie.</p>	<p>throughout the area, April-August.</p> <p>2. Remove Russian-Olives and other non-native trees from marsh area; accelerate efforts to control common teasel and other invasive weeds.</p> <p>3. Strengthen warnings along fenced area east of inlet to absolutely prohibit hikers and their pets from entering inlet and marsh wildlife areas. Heighten enforcement.</p> <p>4. Institute seeding of native grasses in upland areas south and west of the marsh area. Erect prairie dog fences to protect these areas from prairie dog incursion.</p> <p>5. Continue annual monitoring of nesting birds of special concern.</p>
<p>Little Dry Creek and Shoreline</p>	<p>1. Critical nesting habitat for American Bittern and Northern Harrier.</p> <p>2. Marsh and riparian breeding habitat for native songbirds.</p> <p>3. Crowded cattail marsh west of road supports relatively low densities of marsh-nesting birds.</p> <p>4. Lack of silt deposition in inlets limits quality of nesting and foraging habitat for native ducks and shorebirds.</p> <p>5. Non-marsh areas support extensive prairie dog colonies and severely degraded grasslands dominated</p>	<p>1. Enhance protection of marsh areas west and east of North 51st Street from disturbance by recreationists and their pets.</p> <p>2. Increase plant species diversity and decrease cattail density in cattail marsh west of North 51st Street.</p> <p>3. Investigate possibility of increasing silt flow into inlets without reducing extent of marsh vegetation east and west of North 51st Street.</p> <p>4. Increase percentage of native plants within wetland areas and adjacent grassland areas.</p> <p>5. Retain thriving prairie dog colonies while restricting their extent.</p>	<p>1. Continue to prohibit hiking within marsh areas throughout April-August nesting season. Heighten enforcement.</p> <p>2. Conduct fall burns in cattail marsh west of road. Consider using Bobcats or other lightweight equipment to create shallow ponds and drier knoll and ridge areas within this marsh.</p> <p>3. Initiate a study of silt flows from Little Dry Creek into the reservoir and investigate possibility of removing some check dams without decreasing extent of marsh vegetation.</p> <p>4. Continue weed control efforts within marsh and in adjacent grasslands, and</p>

	by non-native species.		<p>plant native grasses in disturbed areas outside prairie dog colonies.</p> <p>5. Institute prairie dog management plan that sets goals for extent of prairie dog colonies and designates both "prairie dog conservation" and "no prairie dog" areas.</p> <p>6. Continue annual monitoring of nesting birds of special concern.</p>
North Shore	<p>1. Shoreline areas and open water support nesting Spotted Sandpipers and migrating grebes.</p> <p>2. "Bathtub-ring" effect limits breeding opportunities for ducks and shorebirds.</p> <p>3. Degraded prairies limit breeding opportunities for grassland-nesting birds.</p> <p>4. Ravines and shoreline woodlands support small nesting populations of native songbirds.</p>	<p>1. Increase native shrub growth along shoreline.</p> <p>2. Restore areas impacted by social trails.</p> <p>3. Restore native vegetation to ravines and grassland areas.</p>	<p>1. Plant native willows and other native shrubs along shoreline.</p> <p>2. Close social trails.</p> <p>3. Remove Russian-Olives from ravine and shoreline areas, and plant native grasses in disturbed grasslands.</p>
South Dam	<p>1. Degraded grasslands and wetlands support nesting Vesper Sparrows, Blue Grosbeaks, and Meadowlarks.</p> <p>2. Alkaline marshes support low densities of nesting birds.</p> <p>3. Current uses of area, including water treatment facility and fire training station, limit native habitat restoration potential.</p>	<p>1. Where possible, restore degraded upland areas and marshes to native vegetation.</p> <p>2. Reduce extent of invasive weeds.</p>	<p>1. Continue aggressive weed control and removal of Russian-Olives throughout area.</p> <p>2. Institute prairie dog management plan that sets goals for extent of prairie dog colonies and designates both "prairie dog conservation" and "no prairie dog" areas.</p>

South Shore	<p>1. High use area is dominated by parking lots, beaches, and other recreational facilities. Loud noise from recreational events may disturb nesting Osprey and other birds.</p> <p>2. Riparian woodlands in Dream Cove area support relatively high densities of nesting songbirds; however, most are urban-adapted generalists.</p> <p>3. Small cattail marsh adjacent to entrance road supports nesting Canada Geese, Mallards, and blackbirds.</p>	<p>1. Enhance protection of existing cattail marsh and riparian areas from human disturbance.</p> <p>2. Strive to limit major recreational events and loud noises from music or other sources during the breeding bird season.</p>	<p>1. Post informational signs advising users not to enter cattail marsh and dense riparian area west of Dream Cove during April-August breeding season.</p> <p>2. Avoid scheduling major recreational events at the reservoir during the May-June heart of the breeding season for birds of special concern.</p> <p>3. Eliminate the playing of loud music from reservoir beaches during the May-June heart of the breeding season for birds of special concern.</p>
Boulder Reservoir Open Water	<p>1. More than 90 species of migrating duck, grebe, loon, heron, shorebird, and gull use the reservoir for resting and foraging.</p> <p>2. Rare migrants, including Tundra Swan, Pacific Loon, and Red-necked Grebe have been observed.</p> <p>3. Western Grebes, American White Pelican, and Common Mergansers float on the reservoir throughout the summer season.</p>	<p>1. Continue to provide safe havens (boating exclosures) for waterbirds around the various reservoir inlets and outlets.</p> <p>2. Monitor migrating water bird populations and map concentration areas.</p>	<p>1. Continue using buoys to restrict boating around the various reservoir inlets and outlets.</p> <p>2. Institute a program of annual monitoring of migrating and wintering water bird populations at the reservoir by volunteers. Use results to designate safe havens for migrating and wintering waterbirds.</p>

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Finally, I particularly appreciate the help of mathematician and longtime friend Benjamin Hoffman, who entered data into the Distance program and conducted the preliminary analysis of results.

Appendix I. Photos of Habitats and Birds



Little Dry Creek inlet and marsh from reservoir main entrance. Note prairie dog barrier fence.



Little Dry Creek cattail marsh west of North 51st Street, showing prairie dog colony (foreground) and dense cattail growth. Northern Harriers nested in this cattail marsh from 2004-09.



2008 failed Northern Harrier nest in Little Dry Creek cattail marsh 40 m west of North 51st Street.



Little Dry Creek north inlet from North 51st Street. Note Osprey nesting poles near center of photo.



Ferruginous Hawk in Little Dry Creek valley. Fairly common during winter at Boulder Reservoir during the 1990s, these large Buteos have become rare throughout Boulder County.



Ravine south and west of Anthill. Note Russian-Olives and non-native willows.



Dry Creek marsh showing sedge/rush meadow, cattail marsh, cottonwood groves, and Russian-Olives.



Young Northern Harriers on ground nest in Dry Creek cattail marsh, July 1987.



Osprey bringing nesting material to platform in eastern Boulder County. Gregg Goodrich courtesy photo.



Dry Creek inlet from North parking area. Note smooth brome-dominated non-native grassland and Russian-Olives.



Hikers walking within Dry Creek wildlife closure, 3 September 2013



Hikers and dogs within Dry Creek wildlife closure, 3 September 2013



American White Pelicans, Canada Geese, Cackling Geese, and various ducks in Dry Creek inlet, 3 September 2013.



American White Pelicans, Egret species, Canada Geese, and ducks in Dry Creek inlet. 3 September 2013.



Great Blue Heron with Ring-billed Gulls and Canada Geese in Dry Creek inlet, 3 September 2013.



Typical Cinnamon Teal nesting habitat (photographed at Lower Latham Reservoir in Weld County). Cinnamon and Blue-winged Teal have nested in the Little Dry Creek and Dry Creek wetlands, but habitat degradation appears to limit nesting opportunities.



Prairie Falcon soaring south of Monarch Road (800 m north of the study area). Both Prairie Falcons and Peregrine Falcons hunt at Boulder Reservoir.



American Bittern nesting territory in Coot Lake wetlands. Note Russian-Olives.



North dam north prairie dog colony. Most of the vegetation in the photo is comprised of non-native grasses and forbs, including Cheatgrass and Bindweed.



Mixed-grass prairie, marsh, and prairie dog colony east of south dam.

Appendix II. Point-Count Station Locations and Descriptions

1. 13T 0479998E; 4435875N. 5183'. Willow sapling in willow thicket 30 m south of shoreline and 100 m north of reservoir entrance road. Emergent wetland, willow carr, riparian woodland, open water.
2. 13T 0479774E; 4436137N. 5215'. Peach-leaf willow on knoll beside prairie dog colony 50 m east of road. Prairie dog colony, mixed-grass prairie, emergent wetland.
3. 13T 0479374E; 4436355N. 5222'. Cottonwood on south edge of Little Dry Creek marsh halfway between North 51st Street and Lake Valley pond. Emergent wetland, riparian woodland, mixed-grass prairie, prairie dog colony.
4. 13T 0479585E; 4436448N. 5223'. Fencepost on northeast side of Little Dry Creek marsh 30 m west of bend in road. Emergent wetland, teasel, mixed-grass prairie.
5. 13T 0479844E; 4436435N. 5224'. Forked peach-leaf willow on north edge of Little Dry Creek cattail marsh 40 m south of road. Emergent wetland, mixed-grass prairie, riparian woodland.
6. 13T 0480409E; 4436590. 5205'. Cottonwood in dense cottonwood grove 30 m west of small inlet. Riparian woodland, emergent wetland, mixed-grass prairie, shoreline, open water.
7. 13T 0480398E; 4436903N. 5204'. Prominent fencepost on south side of marsh encircling inlet southeast of Anthill. Emergent wetland, mixed-grass prairie, shrubland, teasel, shoreline, open water.
8. 13T 0480144 E; 4436951N. 5224'. Metal fencepost at north end of the fence line on south side of drainage that passes south of Anthill. Mixed-grass prairie, willow carr, emergent wetland, riparian woodland, prairie dog colony.
9. 13T 0480384E; 4437305N. 5205'. Prominent pair of cottonwoods in grove northeast of cattail marsh. Mixed-grass prairie, emergent wetland, riparian woodland, barren ground.
10. 13T 048 0251E; 4437450N. 5209'. Rebar on south bank of Dry Creek 30 m east of road. Shrubland, emergent wetland, mixed-grass prairie, teasel.
11. 13T. 0480611E; 4437207N. 5184'. Sprawling willow on east bank of inlet. Willow carr, riparian woodland, shoreline, open water, emergent wetland, mixed-grass prairie.

12. 13T 0481500E; 4437305N. 5207'. West end of cottonwood grove on north shore of reservoir. Open water, shoreline, riparian woodland, barren ground, mixed-grass prairie.

13. 13T 0481602E; 4437489N. 5233'. Southeast end of cottonwood grove on small drainage branching off of feeder canal. Riparian woodland, emergent wetland, shrubland, mixed-grass prairie.

14. 13T 0481763E; 4437642N. 5222'. Great blue heron interpretive sign along trail on north side of Coot Lake marsh. Emergent wetland, riparian woodland, agricultural, barren ground, mixed-grass prairie.

15. 13 T 0481957E; 4437334N. 5223'. Large signpost along north side of trail near southeast corner of Coot Lake wetland. Emergent wetland, riparian woodland, barren ground, mixed-grass prairie.

16. 13 T 0482270E; 4437238N. 5251'. Bench 50 m wsw of Coot Lake parking area. Shoreline, non-native riparian woodland, barren ground, mixed-grass prairie.

17. 13T 0482214E; 4436728N. 5232'. Lone telephone pole in the largest drainage below east dam face. Mixed-grass prairie, emergent marsh, riparian woodland. Blue marker is on adjacent Russian olive.

18. 13T 0481812E; 4436085N. 5179'. Solitary post 10 m southeast of prominent gate about 30 m below southeast dam face. Mixed-grass prairie, barren ground, emergent wetland.

19. 13T 0481240E; 4435582N. 5235'. Small cottonwood grove at base of dam at east end of marina beach. Shoreline, open water, barren ground, riparian woodland.

20. 13T 0480260E; 443586. 5225'. Slightly isolated cottonwood 20 m south of shoreline in Dream Cove picnic area. Shoreline, barren ground, open water, riparian woodland.

Appendix III. Birds Seen or Heard within 1 km of Boulder Reservoir

Occurrence Codes:

Y: year-round resident S: summer resident M: migrant W: winter resident (underlining denotes confirmed breeder)

Habitat Codes

AEM: emergent wetland ASL: Shoreline CPL: croplands LRD: riparian woodland MSB: bridges MSP: poles OWL: open water
RRL: rural residential SLE: shrubland TNG: mixed-grass prairie TSG: shortgrass prairie WJJ: juniper woodland

Abundance Codes:

1: abundant 2: common 3: fairly common 4: uncommon 5: rare

Colorado Natural Heritage Program global ranking codes:

G3: vulnerable to extirpation or extinctio; G4: widespread, abundant, and apparently secure;

G5: demonstrably widespread, abundant and secure; T, rank applies to subspecies.

State Ranking Codes:

S1, state critically imperiled; S2, state imperiled; S3, state rare or uncommon; S4, state apparently secure; B, breeding
N, non-breeding populations.

Boulder County Nature Association birds of special concern codes:

1: Rare and declining. Three or fewer annually documented nesting sites within the county.

3: Rare

4: Isolated and restricted (limited breeding habitat).

6: Extirpated as a locally breeding species.

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Ducks, Geese, and Swans							
Greater White-fronted Goose	M	OWL	5				BCAS
Snow Goose	M	OWL	4				BCAS
Ross's Goose	M	OWL	5				BCAS
Cackling Goose	W	OWL	3				BCAS
Canada Goose	<u>Y</u>	ASL, AEM, OWL	1				Jones 2013
Trumpeter Swan	W	ASL, OWL	5				BCAS
Tundra Swan	W	ASL, OWL	5				BCAS
Wood Duck	<u>Y</u>	ASL, OWS	3				Jones 2013
Gadwall	M	ASL, OWL	2				Jones 2013
American Wigeon	M	OWL	1				Jones 2013
Mallard	<u>Y</u>	ASL, AEM, OWL	1				Jones 2013
Blue-winged Teal	<u>S</u>	ASL, OWL	2				Jones 2013
Cinnamon Teal	S	AEM, OWL	2				Jones 2013
Northern Shoveler	Y	ASL, AEM, OWL	2				Jones 2013
Northern Pintail	M	OWL	3				Jones 2013
Green-winged Teal	<u>Y</u>	ASL, OWL	2				Jones 2013
Canvasback	M	OWL	3				BCAS
Redhead	M	OWL	1				Jones 2013
Ring-necked Duck	M	OWL	2				Jones 2013
Greater Scaup	M	OWL	4				Jones 2013
Lesser Scaup	M	OWL	3				Jones 2013
Surf Scoter	M	OWL	5				BCAS
White-winged Scoter	M	OWL	5				eBird
Black Scoter	M	OWL	5				BCAS
Long-tailed Duck	M	OWL	5				BCAS

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Bufflehead	M	OWL	4				BCAS
Common Goldeneye	M	OWL	2				BCAS
Hooded Merganser	M	OWL	3				BCAS
Common Merganser	M	OWL	2				BCAS
Red-breasted Merganser	M	OWL	4				BCAS
Ruddy Duck	M	OWL	3				BCAS
Grouse, Turkeys, and Quail							
Northern Bobwhite	Y	LRD	5			1	Jones 2013
Chukar	Y	LRD	5				BCAS
Ring-necked Pheasant	Y	LRD	5				BCAS
Loons and Grebes							
Red-throated Loon	M	OWL	5				eBird
Pacific Loon	M	OWL	5				BCAS
Common Loon	M	OWL	4				BCAS
Pied-billed Grebe	Y	OWL	2				Jones 2013
Horned Grebe	M	OWL	3				BCAS
Eared Grebe	M	OWL	3			1	Jones 2013
Red-necked Grebe	M	OWL	5				BCAS
Western Grebe	Y	OWL	1				Jones 2013
Clark's Grebe	M	OWL	3				BCAS
Double-crested Cormorant	S	AEM, OWL	2				Jones 2011
American White Pelican	S	ASL, OWL	2		G3; S1B		Jones 2011
Brown Pelican	M	OWL	5				BCAS
Bitterns and Herons							
American Bittern	<u>S</u>	AEM	4			4	Jones 2013
Great Blue Heron	<u>Y</u>	AEM, ASL	1				Jones 2013
Great Egret	S	ASL	3			3, 4	Jones 2013
Snowy Egret	S	ASL	3		G5; S2B		BCAS
Cattle Egret	S	ASL	5				BCAS
Green Heron	S	AEM, ASL	5				BCAS
Black-crowned Night Heron	S	LRD	4				Jones 2012
Glossy Ibis	M	ASL	5				eBird
White-faced Ibis	M	ASL	3		G5; S2B		Jones 2013
New World Vultures							
Turkey Vulture	S	TMG	2				Jones 2013
Hawks and Eagles							
Osprey	<u>S</u>	MSP, ASL	2				Jones 2013
Bald Eagle	Y	LRD, ASL	3	ST	G5; S1B, S3N	4	Jones 2013
Northern Harrier	<u>Y</u>	AEM, TMG	3			1, 4	Jones 2013
Sharp-shinned Hawk	M	LRD	4				BCAS
Cooper's Hawk	Y	LRD	4				Jones 2013
Broad-winged Hawk	M	LRD	5				BCAS
Swainson's Hawk	<u>S</u>	LRD	3				Jones 2013

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Red-tailed Hawk	<u>Y</u>	LRD, RRL	2				Jones 2013
Ferruginous Hawk	W	TMG	4	SC	G4; S3B, S4N		BCNA
Rough-legged Hawk	W	TMG	4				BCNA
Golden Eagle	Y	TMG	4				BCAS
Coot, Rails, and Crane							
Virginia Rail	Y	AEM	3				Jones 2012
Sora	S	AEM	3				Jones 2012
American Coot	<u>Y</u>	AEM, OWL	2				Jones 2013
Sandhill Crane	M	AEM	4	SC	G5T4;S2B,S4N		BCAS
Shorebirds							
Semipalmated Plover	M	ASL	4				BCAS
Killdeer	<u>Y</u>	ASL	1				Jones 2013
Mountain Plover	S	TSG	5	SC	G2;S2B	6	eBird
American Avocet	S	ASL	3				BCAS
Spotted Sandpiper	<u>S</u>	ASL	2				BCAS
Solitary Sandpiper	M	ASL	4				BCAS
Greater Yellowlegs	M	ASL	3				BCAS
Lesser Yellowlegs	M	ASL	3				BCAS
Willit	M	ASL	4		G5;S1B		BCAS
Whimbrel	M	ASL	5				Ebird
Long-billed Curlew	S	ASL	4	SC	G5; S2B	6	Jones 2013
Hudsonian Godwit	M	ASL	5				BCAS
Marbled Godwit	M	ASL	4				BCAS
Sanderling	M	ASL	4				eBird
Semipalmated Sandpiper	M	ASL	4				BCAS
Western Sandpiper	M	ASL	3				BCAS
Least Sandpiper	M	ASL	4				BCAS
Baird's Sandpiper	M	ASL	2				BCAS
Pectoral Sandpiper	M	ASL	5				BCAS
Still Sandpiper	M	ASL	5				BCAS
Ruff	M	ASL	5				eBird
Long-billed Dowitcher	M	ASL	4				BCAS
Wilson's Snipe	<u>Y</u>	AEM	2				Jones 2013
Wilson's Phalarope	S	AEM	3		G5;S4B,S4N		BCAS
Red-necked Phalarope	M	OWL	5				BCAS
Red Phalarope	M	OWL	5				BCAS
Long-tailed Jagger	M	OWL	5				BCAS
Gulls and Terns							
Sabine's Gull	M	ASL, OWL	5				BCAS
Bonaparte's Gull	M	ASL, OWL	4				BCAS
Franklin's Gull	M	ASL, OWL	2				Jones 2013
Mew Gull	M	OWL	5				BCAS
Ring-billed Gull	Y	ASL, OWL	1				Jones 2013
California Gull	S	ASL, OWL	3				BCAS
Herring Gull	W	ASL, OWL	3				BCAS

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Thayer's Gull	M	ASL, OWL	4				BCAS
Slaty-backed Gull	M	ASL, OWL	5				BCAS
Caspian Tern	M	ASL, OWL	5				BCAS
Black Tern	M	OWL	3				BCAS
Common Tern	M	OWL	5				BCAS
Arctic Tern	M	OWL	5				BCAS
Forster's Tern	M	ASL, OWL	3		G5, S2B, S4N		BCAS
Doves and Cuckoos							
Rock Pigeon	<u>Y</u>	RRL	2				Jones 2013
Eurasian Collared-Dove	<u>Y</u>	RRL	1				Jones 2013
White-winged Dove	S	LRD, RRL	4				eBird
Mourning Dove	<u>S</u>	LRD	1				Jones 2013
Owls							
Barn Owl	<u>S</u>	RRL	4				Jones 2013
Great Horned Owl	<u>Y</u>	LRD, RRL	2				Jones 2013
Burrowing Owl	<u>S</u>	TSG	3	ST	G4, S4B	4	Jones 2013
Long-eared Owl	M	LRD, RRL	5				eBird
Short-eared Owl	W	AEM	5				BCAS
Nightjars and Swifts							
Common Nighthawk	S	TMG, LRD	3				Jones 2013
White-throated Swift	M	TMG	4				BCAS
Hummingbirds							
Broad-tailed Hummingbird	M	LRD, SLE	3				BCAS
Kingfisher							
Belted Kingfisher	Y	ASL	3				Jones 2013
Woodpeckers							
Lewis's Woodpecker	S	LRD	5			2	BCAS
Red-headed Woodpecker	<u>S</u>	LRD	5			2	Jones 2013
Downy Woodpecker	<u>Y</u>	LRD	2				Jones 2013
Hairy Woodpecker	Y	LRD	3				Jones 2013
Northern Flicker	<u>Y</u>	LRD	1				Jones 2013
Falcons							
American Kestrel	<u>Y</u>	LRD	2				Jones 2013
Merlin	M	LRD	4				BCNA
Peregrine Falcon	Y		4	SC	G4T4; S2B G5; S4B, S4N		BCAS
Prairie Falcon	Y	TMG	3				BCNA
Tyrant Flycatchers							
Western Wood-Pewee	M	LRD	3				Jones 2013
Say's Phoebe	S	TMG	3				Jones 2013
Western Kingbird	<u>S</u>	LRD	2				Jones 2013

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Eastern Kingbird	<u>S</u>	LRD	2				Jones 2013
Shrikes							
Loggerhead Shrike	S	TSG, WJJ	4			1, 4	BCAS
Northern Shrike	W	TMG	4				BCAS
Vireos							
Warbling Vireo	S	LRD	2				BCAS
Red-eyed Vireo	M	LRD	5				eBird
Jays and Crows							
Blue Jay	<u>Y</u>	LRD	3				Jones 2013
Black-billed Magpie	<u>Y</u>	LRD	2				Jones 2013
American Crow	Y	LRD	2				Jones 2013
Common Raven	Y	LRD, TMG	3				Jones 2013
Larks							
Horned Lark	Y	TSG	3				Jones 2013
Swallows							
Tree Swallow	S	OWL, AEM	2				BCAS
Violet-green Swallow	S	OWL, AEM	2				BCAS
N. Rough-winged Swallow	S	TSG, AEM, OWL	2				BCAS
Bank Swallow	S	ASL, OWL	4				BCAS
Cliff Swallow	<u>S</u>	MSB, RRL	1				BCAS
Barn Swallow	<u>S</u>	MSB, RRL	2				BCAS
Chickadees and Titmice							
Black-capped Chickadee	Y	LRD	2				Jones 2013
Mountain Chickadee	Y	WJJ	3				Jones 2013
Nuthatches							
White-breasted Nuthatch	Y	LRD	3				BCAS
Pygmy Nuthatch	M	WJJ	5				BCAS
Brown Creeper	Y	LRD	3				BCAS
Wrens and Gnatcatcher							
Rock Wren	S	ASL, MCL	4				BCAS
House Wren	S	LRD	3				Jones 2012
Sedge Wren	M	AEM	5				BCAS
Marsh Wren	S	AEM	4				Jones 2012
Blue-gray Gnatcatcher	M	LRD, WJJ	4				BCAS
Kinglets							
Ruby-crowned Kinglet	M	LRD, WJJ	3				BCAS
Thrushes							
Eastern Bluebird	M	LRD	4				BCAS
Western Bluebird	M	TMG	3				BCAS

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Mountain Bluebird	S	TMG	3				Jones 2013
Townsend's Solitaire	W	LRD	3				BCAS
Hermit Thrush	M	LRD	4				eBird
American Robin	<u>Y</u>	LRD, RRL	1				Jones 2013
Gray Catbird	S	SLE	4				
Northern Mockingbird	S	LRD	5				BCAS
Thrashers							
Sage Thrasher	M	SLE	4				BCAS
Starlings							
European Starling	<u>Y</u>	LRD, RRL	1				Jones 2013
Pipits							
American Pipit	M	ASL, TMG	3				BCAS
Waxwings							
Cedar Waxwing	M	LRD	4				Jones 2013
Longspurs							
Chestnut-collared Longspur	M	TSG	5				eBird
Wood-Warblers							
Orange-crowned Warbler	M	AEM, LRD	3				BCAS
McGillivray's Warbler	M	AEM	3				eBird
Common Yellowthroat	<u>S</u>	AEM	2				
Blackburnian Warbler	M	LRD	5				Jones 2013
Yellow Warbler	<u>S</u>	LRD	1				Jones 2012
Yellow-rumped Warbler	M	LRD	1				Jones 2013
Townsend's Warbler	M	LRD, WJJ	4				BCAS
Wilson's Warbler	M	LRD/SLE	3				BCAS
Towhees							
Green-tailed Towhee	M	SLE	3				BCAS
Spotted Towhee	S	SLE	3				Jones 2013
Sparrows							
American Tree Sparrow	M	LRD, TMG	1				Jones 2013
Chipping Sparrow	S	LRD, RRL, WJJ	2				Jones 2013
Clay-colored Sparrow	M	TMG	3				BCAS
Brewer's Sparrow	M	TMG	3				BCAS
Vesper Sparrow	<u>S</u>	TMG	2				BCAS
Lark Sparrow	S	TMG	3				BCAS
Sage Sparrow	M	TMG, SLE	5				BCAS
Lark Bunting	S	TMG	4				BCAS
Savannah Sparrow	S	AEM, TMG	4				BCAS
Grasshopper Sparrow	S	TMG	3			4	BCAS
LeConte's Sparrow	M	TMG	5				BCAS
Song Sparrow	<u>Y</u>	AEM	2				Jones 2013

Common Name	Occurr.	Habitat	Abund.	CO Status	CNHP Rank	BCNA Status	Source
Lincoln's Sparrow	M	AEM	3				BCAS
White-crowned Sparrow	M	SLE	3				Jones 2013
Dark-eyed Junco	M	LRD, TMG, WJJ	2				Jones 2013
Tanager, Grosbeaks, Dickcissel							
Western Tanager	M	LRD	3				BCAS
Rose-breasted Grosbeak	M	LRD	5				
Black-headed Grosbeak	S	LRD	3				BCAS
Blue Grosbeak	<u>S</u>	LRD, SLE	2				Jones 2012
Lazuli Bunting	M	SLE	4				BCAS
Dickcissel	S	AEM, CPL	4				Jones 2012
Blackbirds							
Bobolink	S	AEM, CPL	4		G5;S3B	4	BCAS
Red-winged Blackbird	<u>Y</u>	AEM, ASL	1				Jones 2013
Western Meadowlark	<u>Y</u>	TMG	1				Jones 2013
Yellow-headed Blackbird	S	AEM	2				Jones 2013
Brewer's Blackbird	<u>Y</u>	LRD	3				Jones 2012
Common Grackle	<u>S</u>	LRD, RRL	1				Jones 2013
Great-tailed Grackle	S	AEM	3				BCAS
Brown-headed Cowbird	S	LRD, RRL	1				Jones 2013
Orioles							
Orchard Oriole	S	LRD	5				Jones 2013
Bullock's Oriole	<u>S</u>	LRD	2				Jones 2012
Finches							
House Finch	<u>Y</u>	LRD, RRL	2				Jones 2013
Pine Siskin	M	LRD, WJJ	3				BCAS
Common Redpoll	M	TMG	4				eBird
Lesser Goldfinch	S	LRD	2				Jones 2013
American Goldfinch	<u>Y</u>	LRD, RRL	1				Jones 2013
Weaver Finches							
House Sparrow	<u>Y</u>	RRL	2				Jones 2013

Sources:

BCAS: Boulder County Audubon Society. 1979-2013. Monthly Wildlife Inventories.

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eBird. <http://ebird.org/content/ebird/>

Appendix IV: Point Count Results

Table 1. Breeding season (June-July) point-count results, points 1-10. Mean number per survey.

Species	1	2	3	4	5	6	7	8	9	10
Canada Goose	2.7	6.0					8.3	0.3	0.3	
Gadwall							3.7		0.7	
Mallard	1.3	15.3				1.7			1.0	
Blue-winged Teal										
Double-crested Cormorant					0.7					
American White Pelican		0.3								
American Bittern									0.3	
Osprey					0.7		1.0			
Killdeer	0.3	1.0		0.3	0.7	1.0			1.3	0.7
Spotted Sandpiper						1.0				0.3
Wilson's Snipe		0.7		1.3	1.3					
Ring-billed Gull						0.3				
Sora			0.3	0.3						
Eurasian Collared-Dove					0.3		0.3			
Mourning Dove	2.0	0.7	0.3	3.0	1.0	0.3	0.3		1.3	0.7
Broad-tailed Hummingbird	0.3						0.3			
Belted Kingfisher										
Northern Flicker										
Western Wood-Pewee								0.3		
Western Kingbird					1.0			0.7	1.3	0.7
Eastern Kingbird		0.7		0.3		0.3	0.3			
Black-billed Magpie			0.3		0.7					0.3
Tree Swallow		0.3							0.3	0.3
Cliff Swallow	2.7	2.0	1.3	2.0	3.0	5.3	3.3	2.7	3.7	3.7
Barn Swallow	0.3	1.3	0.7		0.7					
American Robin		1.0		0.3			0.3		0.7	
European Starling	0.3	1.3						2.7		
Common Yellowthroat	1.3	0.3	1.3	2.3	1.7		1.0	2.0	1.7	1.3
Yellow Warbler	1.0	0.7	0.7		1.0		1.0		1.0	
Yellow-rumped Warbler				0.3				1.0	0.7	
Vesper Sparrow						0.3				
Song Sparrow	0.7		0.3		0.3		1.0		0.7	
Sparrow species								0.3		
Blue Grosbeak				0.3				1.3		0.3
Dickcissel								0.3		
Red-winged Blackbird	11.3	3.7	7.0	4.7	10.0	1.7	6.3	6.7	12.0	6.7
Western Meadowlark	0.7	2.7	1.7	1.7	1.3	1.0	1.7	2.0	1.0	1.0
Yellow-headed Blackbird		0.7								
Brewer's Blackbird		0.7						0.3		0.7
Common Grackle	4.0	0.3	0.3			0.3			0.7	0.3
Brown-headed Cowbird	0.7		1.7	0.7				1.7	1.0	

Orchard Oriole										
Bullock's Oriole			1.0		0.7		0.7		0.3	0.3
House Finch										0.3
American Goldfinch		0.3	1.3	0.3		1.0	0.3	2.0	1.0	
Passerine species			0.3	0.3				0.3		
Mean species	10.7	11.0	8.7	8.0	9.7	5.7	10.3	9.3	10.3	7.3
Mean individuals	29.7	40.0	18.7	18.3	25.0	14.3	30.0	24.7	31.0	17.7

Table 1b. Breeding season (June-July) point-count results, points 1-10. Mean number per survey.

Species	11	12	13	14	15	16	17	18	19	20	Total
Canada Goose	0.7									34.0	52.3
Wood Duck					0.3						0.3
Gadwall	0.7										5.0
Mallard	4.3										23.7
Blue-winged Teal	1.7										1.7
Cinnamon Teal	0.3										0.3
Redhead	1.0										1.0
Northern Bobwhite									0.3		0.3
Clark's Grebe					0.3						0.3
Western Grebe										0.3	0.3
Double-crested Cormorant											0.7
American White Pelican										0.3	0.7
American Bittern					0.3						0.7
Osprey											1.7
Killdeer	1.7				0.3	1.0	0.7	0.7		0.3	10.3
Spotted Sandpiper					0.3					0.3	2.0
American Avocet	0.7										0.7
Wilson's Snipe							0.3				3.7
Ring-billed Gull											0.3
Sora							0.3				1.0
Eurasian Collared-Dove						0.7			0.3	0.3	2.0
Mourning Dove	0.7	0.3	0.7	2.7	0.3	0.3	0.7	0.7	1.0	1.0	18.0
Broad-tailed Hummingbird											0.7
Belted Kingfisher		0.3		0.3	0.3				0.3		1.3
Northern Flicker						0.3		0.3		0.3	1.0
Western Wood-Pewee											0.3
Western Kingbird				0.3		1.3	0.7	0.3	0.3		6.7
Eastern Kingbird	0.3		0.3	0.3						0.3	3.0
Black-billed Magpie											1.3
Tree Swallow										0.3	1.3
Cliff Swallow	3.7	4.7	8.0	1.7	4.0	1.3	14.7	9.7	6.0	2.7	86.0
Barn Swallow	1.0			0.3						0.3	4.7
Black-capped Chickadee									0.3		0.3
American Robin		0.3	1.3	1.0	1.3	1.0			1.0	2.3	9.7
Gray Catbird			0.3								0.3

European Starling							0.7		1.3		6.3
Common Yellowthroat	0.7		0.7	2.0	2.0		0.7				19.0
Yellow Warbler	1.3	1.0	1.7	2.7	2.0	0.7				0.7	15.3
Yellow-rumped Warbler											2.0
Vesper Sparrow							1.0	1.0	0.3		2.7
Song Sparrow	1.0		0.3	2.0	1.0						7.3
Sparrow species											0.3
Blue Grosbeak	0.7		1.7	0.3	0.3		0.7	0.3	0.7		6.7
Dickcissel				1.0							1.3
Red-winged Blackbird	4.7	4.3	4.3	7.7	5.7	0.3	3.7	0.3	0.3	1.7	103.0
Western Meadowlark	2.0	0.7	2.0	0.3	1.3	0.7	2.3	2.3	0.7	1.3	28.3
Yellow-headed Blackbird											0.7
Brewer's Blackbird	0.7	5.0		1.3						2.3	11.0
Common Grackle		1.7		0.3	0.3	2.0		0.3	2.0	3.0	15.7
Brown-headed Cowbird	1.7		0.7		1.0		1.3	0.3	0.7	0.3	11.7
Blackbird species						1.0					1.0
Orchard Oriole	0.3										0.3
Bullock's Oriole	0.7		0.3	0.3		2.0	0.3			0.3	7.0
House Finch			1.3					0.7	2.3		4.3
Lesser Goldfinch			0.7	0.7							1.3
American Goldfinch	0.7	0.3	2.3	2.3	1.0	1.7			0.3	0.7	15.7
Passerine species						0.7					1.3
Mean species	12.0	5.3	9.3	10.3	10.0	8.0	8.0	6.0	8.3	11.7	
Mean individuals	31.0	18.7	26.7	27.7	22.3	15.0	28.0	17.0	18.3	53.3	

Table 2a. Spring migration (April-May) point-count survey results, points 1-10. Mean number per survey.

Species	1	2	3	4	5	6	7	8	9	10
Canada Goose	1.5	1.5								
Gadwall		1.5				0.5				
American Wigeon							1.5			
Mallard	1.0		0.5		1.0					
Northern Shoveler							0.5			
Northern Pintail							0.5			
Green-winged Teal							0.5			
Western Grebe						0.5	0.5			
American White Pelican							2.5			
Great Blue Heron								0.5		
White-faced Ibis							9.0			
Osprey					1.0					
American Kestrel						0.5				
Killdeer		0.5	0.5			0.5	0.5			0.5
Spotted Sandpiper						2.0				
Lesser Yellowlegs							2.0			
Wilson's Snipe			0.5						0.5	3.5
Ring-billed Gull							0.5			0.5
Virginia			0.5							
Eurasian Collared-Dove	0.5	0.5								
Mourning Dove	1.5		0.5	1.5	0.5		0.5			
Belted Kingfisher										
Northern Flicker			0.5				0.5	0.5		0.5
Western Kingbird					0.5					
Eastern Kingbird							0.5			
Black-billed Magpie		0.5	0.5	1.0				0.5		
Black-capped Chickadee	0.5									
American Robin	0.5	0.5								
European Starling	1.5								0.5	
Yellow Warbler			0.5				0.5			
Yellow-rumped Warbler				0.5		1.5			0.5	
Common Yellowthroat			0.5	1.0	0.5		1.0	0.5		
Vesper Sparrow						0.5			0.5	
Song Sparrow					0.5		0.5	1.5		
Dickcissel										
Red-winged Blackbird	11.0	3.5	10.0	10.0	12.0	0.5	5.5	10.0	9.5	9.5
Western Meadowlark	2.5	3.0	0.5	1.0	1.0	0.5	1.5	1.5	2.0	1.5
Brewer's Blackbird								0.5		
Brown-headed Cowbird			0.5	0.5					0.5	
Bullock's Oriole	0.5	0.5			0.5		0.5			0.5
American Goldfinch	1.5			0.5		0.5	0.5		0.5	
Mean species	8.0	5.5	6.5	5.5	5.0	5.0	11.0	5.0	5.0	4.5
Mean individuals	22.5	12.0	15.5	16.0	17.5	7.5	29.5	15.5	14.5	16.5

Table 2b. Spring migration (April-May) point-count survey results, points 11-20. Mean number per survey.

Species	11	12	13	14	15	16	17	18	19	20	Total
Canada Goose					1.0	1.0	1.0			1.0	7.0
Gadwall											2.0
American Wigeon											1.5
Mallard	0.5	1.0		2.0				1.0		3.0	9.0
Northern Shoveler											0.5
Northern Pintail											0.5
Green-winged Teal											0.5
Common Merganser										1.5	1.5
Western Grebe		2.5									1.0
American White Pelican	2.0										4.5
Great Blue Heron					0.5				0.5		1.5
White-faced Ibis											9.0
Osprey											1.0
American Kestrel											0.5
Killdeer	1.0					0.5	1.5	1.0			7.0
American Avocet	5.5										5.5
Spotted Sandpiper	1.0	1.0								0.5	4.5
Lesser Yellowlegs	1.5										3.5
Wilson's Snipe											4.5
Ring-billed Gull	2.0										3.0
Virginia											0.5
Eurasian Collared-Dove						0.5			0.5		2.0
Mourning Dove	1.0			2.0	2.5	1.0				1.0	12.0
Belted Kingfisher			0.5	0.5							1.0
Northern Flicker					1.0						3.0
Western Kingbird						1.0					1.5
Eastern Kingbird			1.5								2.0
Loggerhead Shrike					0.5		0.5				1.0
Blue Jay										0.5	0.5
Black-billed Magpie			1.0							1.0	4.5
Tree Swallow							2.5				2.5
Rough-winged Swallow		0.5									0.5
Barn Swallow		6.0					4.5				10.5
Black-capped Chickadee										1.0	1.5
House Wren			0.5								0.5
American Robin			2.0	2.5	1.5	1.0	10.5	0.5	1.5	1.5	21.5
European Starling			2.0						0.5		4.0
Yellow Warbler	0.5		0.5	0.5	1.0	0.5					4.0
Yellow-rumped Warbler	2.5									0.5	5.5
Blackburnian Warbler	0.5										0.5
Common Yellowthroat			1.0	0.5							5.0
Green-tailed Towhee				1.0							1.0
Chipping Sparrow				1.0				0.5			1.5
Vesper Sparrow								1.5	0.5		3.0

Species	11	12	13	14	15	16	17	18	19	20	Total
Grasshopper Sparrow				1.0							1.0
Song Sparrow			0.5	1.0	0.5						4.5
Sparrow species					0.5						0.5
Red-winged Blackbird	9.5		3.5	8.0	8.0	0.5	4.5	0.5	2.5	2.5	121.0
Western Meadowlark	1.5	1.0	2.5	0.5	1.0	1.5	1.0	1.5	0.5	1.0	27.0
Brewer's Blackbird											0.5
Common Grackle							1.0			2.0	3.0
Brown-headed Cowbird					2.0		2.0				5.5
Bullock's Oriole						0.5					3.0
House Finch						0.5			2.0		2.5
American Goldfinch	0.5		1.0	1.5	0.5	6.5				1.0	14.5
Mean species	9.0	3.0	7.5	8.0	8.0	7.5	6.5	4.0	5.0	9.0	
Mean individuals	29.5	12.0	15.5	22.0	20.5	15.0	29.0	6.5	8.5	18.0	